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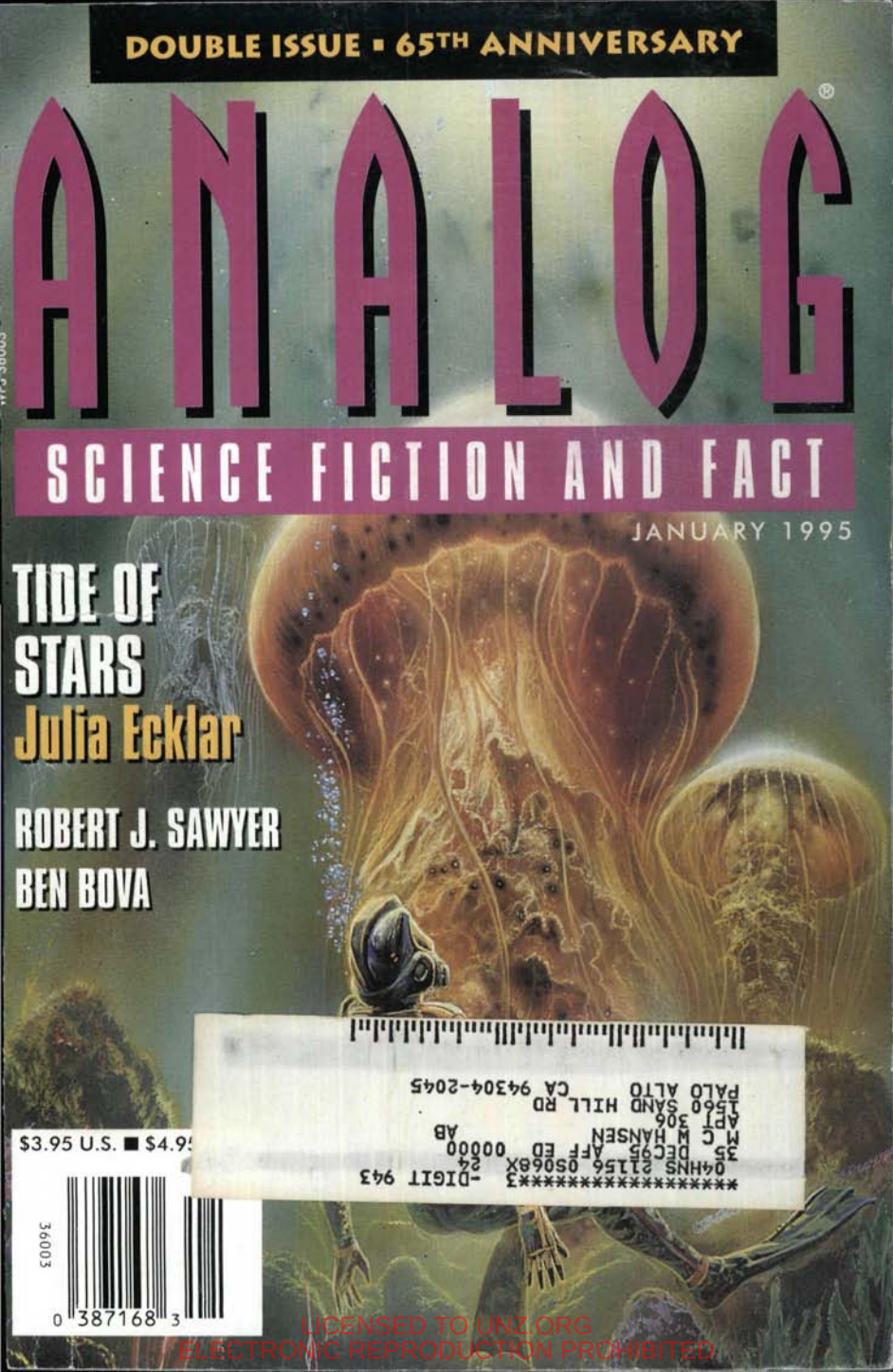

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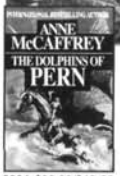

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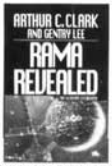

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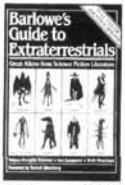

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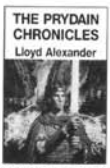

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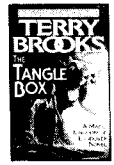

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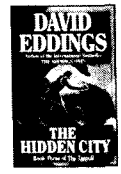

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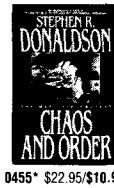

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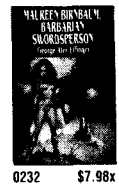

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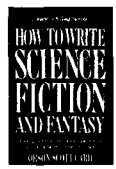

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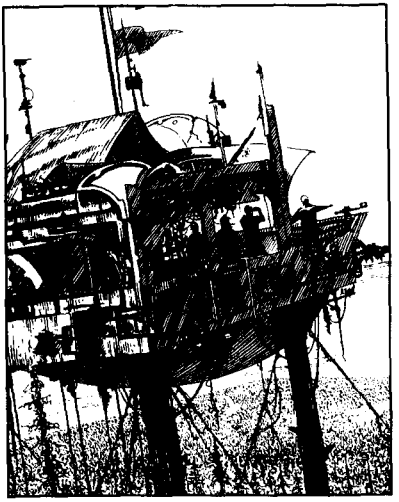

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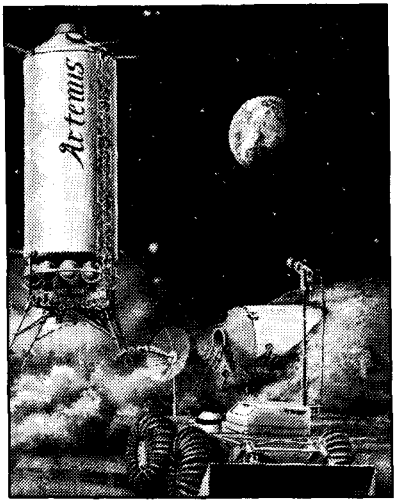

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EDITORIAL Stanley Schmidt

COLD FUSION CONUNDRUM

"The reports of my death," Mark Twain is said to have said, "have been greatly exaggerated."

Could the same be true of cold fusion? And whether it is or not, what might we have learned from that story so far?

I remember vividly when I first heard of cold fusion, a bit more than five years ago as I write this. I was at Norwescon, a science fiction convention in Tacoma, and had just settled down to listen to a panel on nanotechnology. The panel started a bit late: one of the panelists took the first few minutes to relay the news that Stanley Pons and Martin Fleischmann, at the University of Utah, had just announced a research result that seemed too good to be true—but if it *was* true, was very exciting and hinted at implications for the future as profound as those of nanotechnology itself.

The essence of Pons and Fleischmann's claim was that they had constructed a simple room-temperature apparatus that generated more energy (as heat) than was fed into it (as electricity). Superficially, their apparatus looked like a fairly standard electrolysis setup, with two electrodes (a palladium strip surrounded by a platinum coil) immersed in water containing a dissolved salt to make it more conductive. The most obviously unusual feature of the setup was that the water was "heavy water," with deuterium replacing the lighter and much more abundant isotope of hydrogen. Pons and Fleischmann attributed the excess heat they observed to a nuclear fusion reaction involving the deuterium that collected in the palladium electrode when an electrical current was passed through the liquid.

If true, this would be most remarkable and fraught with potential. Nuclear fusion, the kind of process that fuels stars, has long been considered one of the most promising long-term sources of large amounts of clean, renewable energy. Laboratories all over

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the world have been pursuing it for many years, but the goal has been elusive. The only known ways to induce fusion have required producing and confining plasmas in very small spaces at *extremely* high temperatures. This is neither easy nor cheap. Those experiments have consumed large amounts of labor, equipment, electricity, and time, with frustratingly little in the way of positive results. If Fleischmann and Pons had really achieved what they thought they had, their work might point the way to an entirely new approach. It might provide an almost ludicrously cheap and easy way to widespread fusion power, where all the traditional "brute force" approaches had failed.

Established theory didn't seem to offer any mechanism that could explain *how* Fleischmann and Pons's setup could be inducing fusion, but the implications if it was were too important to ignore. So dozens of laboratories around the world began trying to duplicate their results.

Most of their efforts failed. Since the essence of good science is repeatability, and cold fusion sounded pretty unlikely in the first place, interest quickly lost ground to skepticism as lab after lab reported, "We tried it and it didn't work." Pretty soon more and more labs quit trying, and we heard less and less about cold fusion. Sometimes we even heard people hinting without subtlety that it was all just a hoax, or at best an error prematurely announced.

However. . . .

There's an interesting article in the May/June 1994 issue of *Technology Review*, a publication of the Massachusetts Institute of Technology, titled "Warming Up to Cold Fusion." It's by Edmund Storms, a recently retired chemist (formerly at Los Alamos) who has done extensive work on materials used in conventional nuclear reactors and has been doing his own work on cold fusion (or whatever it is) since the first announcement. So have several other people, even though they are largely ignored by current fashion. Storms claims that the significance of some of the early negative reports was exaggerated, and that there have since been enough *positive* results from reputable labs that "to dismiss the claims as . . . error or fraud is no longer appropriate." Whatever is happening might or might not be cold fusion, but it's looking increasingly clear that *something* is happen-

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ing—and that something may be too important to ignore. Whatever it is appears to be a new kind of thing; Storms tentatively calls it "chemically assisted nuclear reactions."

I'm not going to repeat the details of the experiments or Storms's analysis here. I do, however, recommend that you seek out the magazine and read his article carefully. This work *may* turn out to be important both to our understanding of science and to our ability to continue and improve our technological civilization. It is *certainly* important as a reminder of some of the pitfalls inherent in doing, evaluating, managing, or funding research.

One of the first points to be made is that while good science requires that experiments be reproducible—that workers in Lab B should be able to repeat an experiment from instructions provided by Lab A, and get the same results—neither providing nor following the instructions is necessarily as easy as it sounds. As Alfred Korzybski said, "The map is not the territory," and the description, no matter how careful, is not the experiment. Especially when you're dealing with a brand-new phenomenon, not yet understood, there is no way of knowing which parts of the setup are how important.

As John W. Campbell pointed out some years ago, a chemist early in this century, looking at a sample of the semiconductors now used in electronics, would have been quite unable to duplicate them or figure out why they worked. The "doping" that

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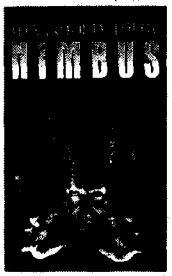

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makes them work involves such small amounts of added material that he probably would have dismissed them as inconsequential trace impurities, if he could detect them at all—which he probably couldn't. Similarly, you can imagine a case in which the discoverer of an effect specified the size and shape of a part of the apparatus, but didn't mention that it was painted blue because that was obviously irrelevant. Except that further work eventually showed that the paint played a key role in what happened, and an identical part with red paint from a different manufacturer didn't work at all. . . .

There is evidence of analogous effects in some of the unsuccessful early attempts to repeat the Pons-Fleischmann experiment. Off-the-shelf commercial palladium, for example, may or may not work; it's likely to contain surface cracks, and the reaction occurs only if the palladium electrode is free of those. On the other hand, it seems to *require* certain surface impurities. At least one researcher found that cells made with Pyrex containers worked while otherwise identical ones in Teflon containers didn't—apparently because aluminum and silicon atoms from the Pyrex gathered on the palladium and helped the deuterium build up to the required concentrations. Perhaps that also helps explain why some experiments showed the reaction if and only if they were allowed to run for several days.

The important point is: when you don't know *how* what you're looking for works, you can't make *any* assumptions about what is or is not necessary for it to work. So the first attempts to duplicate it, no matter how well-intentioned and meticulously carried out, are quite likely to inadvertently change something that looks irrelevant but is actually crucial. Therefore no single early failure to duplicate should be taken as conclusive proof that the effect isn't real. If you get *lots* of failures and no successes, it's reasonable to become increasingly skeptical—but still worthwhile to keep an open mind.

And if you're getting *some* positives, even if you're also getting a lot of negatives, it's just plain bad science to abandon the search and say, "There's nothing there." What you need to do, *especially* if what's happening appears to be fundamentally new, potentially important, and hard to explain, is to encourage people to keep trying the experiment, and related experiments, in an effort to figure out what's going on, why it sometimes works and sometimes doesn't, and, ultimately, *how* it works.

Remember, *any* fundamentally new phenomenon is going to be hard, or even impossible, to explain with preexisting theory. The photoelectric effect and the Michelson-Morley experiment certainly were, when they were new. If they had been shrugged off or dismissed as hoaxes because they weren't explainable with the available theoretical tools, we might never have gotten the new, improved theoretical tools—quantum mechanics and relativity—that are the bread and butter of modern physics.

Unfortunately, those who decide

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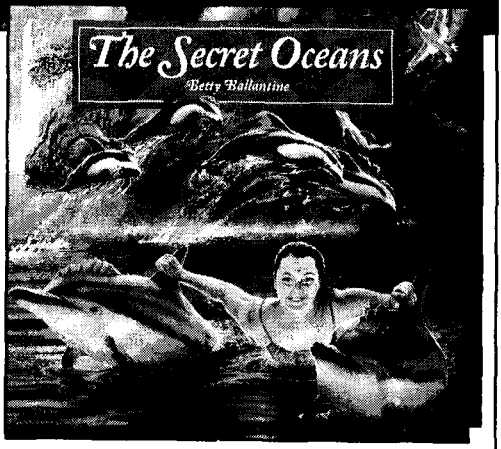

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what research to do—by making administrative or funding decisions—often forget this. As Storms poetically puts it, "... dollars tend to flow toward research with a clear chance of success. Thus many potentially important ideas never receive enough funding to enable scientists to understand them."

Cold fusion is a good example, regardless of the eventual verdict. At present, the jury is still out—or perhaps more precisely, out to lunch. According to Storms, many people and agencies which could and arguably should be supporting work to find out what's going on in these experiments have already made up their minds that the effect is not real and money should not be wasted studying it. The U.S. patent office has stopped issuing patents in this area; the Department of Energy has stopped funding research in it; journals won't publish positive cold fusion results because editors and peer reviewers have already decided that "there ain't no such animal." They *would* publish more, if more had already been published—but nobody wants to stick their neck out and help break that cycle.

If the effect *is* real, and crucially dependent on factors that haven't been fully identified, understanding it and making it reproducible *requires* that many independent experimenters try it (which requires funding) and that they talk to each other (which requires publication). That's not likely to happen unless and until we break free of the "safe research" mentality.

Cold fusion may or may not turn out not to repay the investment made in it—but an exclusive diet of "safe research" surely won't. Fundamental breakthroughs, by definition, *cannot* be predicted or immediately understood. "Research with a clear chance of success" is, by definition, research so closely based on what we already know that it's unlikely to make anybody uncomfortable by producing results that require new ideas to explain them. One of the most disappointing things I learned in grad school was how much research is done not because it's especially worthwhile, fascinating, or important, but simply because somebody needs a Publication and a literature search turns up a possible project that nobody else has done yet. In some cases, maybe the reason nobody's done it is that isn't all that *worth* doing. Maybe somebody's time and money would be better spent doing work whose outcome is less certain, but which just *might* pay off richly and dramatically.

Any financial investor knows that there's a trade-off between risk and income potential. The safest investments pay very low returns; higher returns require greater short-term risk, but tend to pay much better in the long run.

Research is perhaps the most important long-range investment we as a civilization ever make. The risk-versus-potential trade-off applies as much to it as to any other investment. We should allocate our resources accordingly. ■

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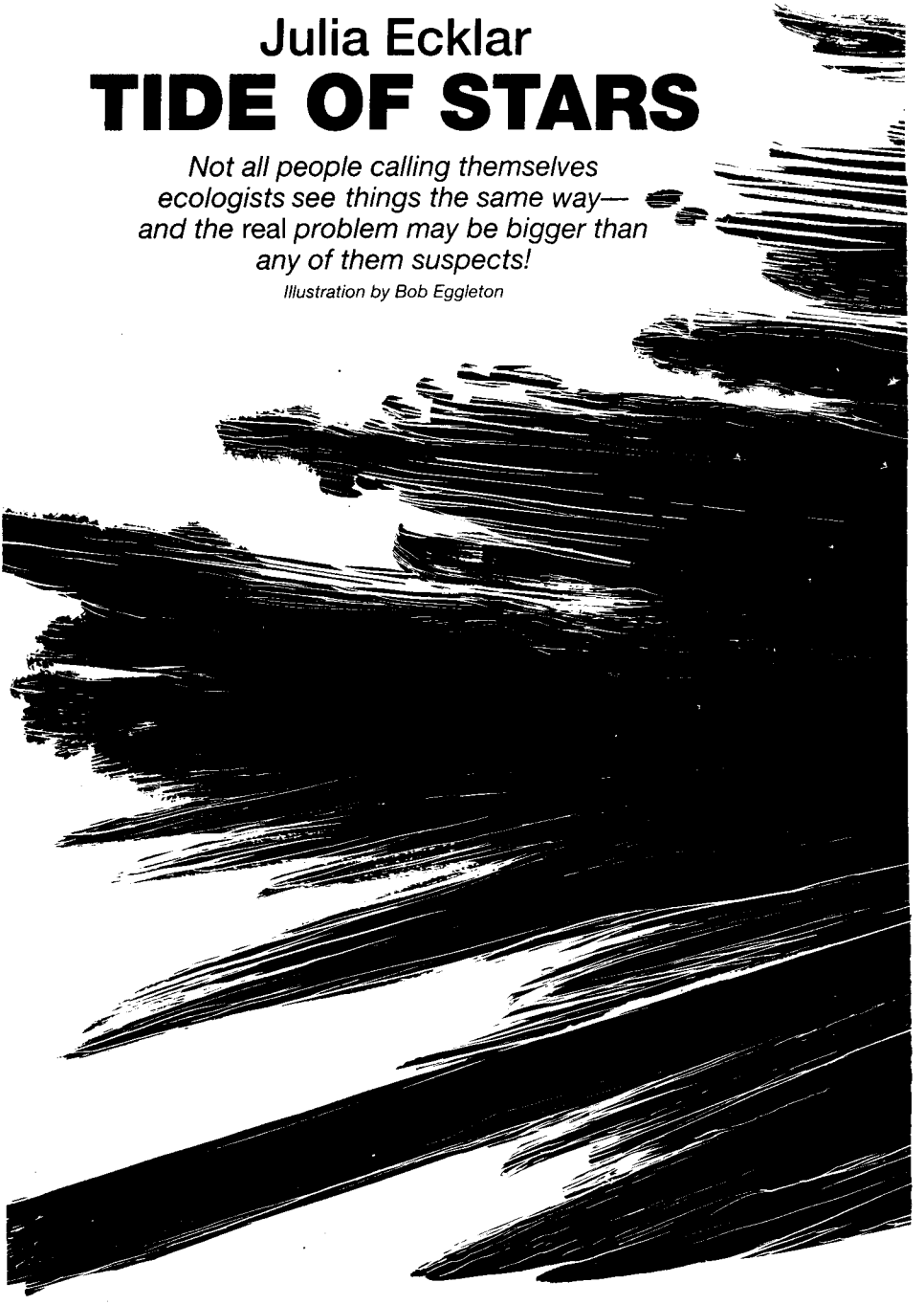
Julia Ecklar

TIDE OF STARS

Not all people calling themselves ecologists see things the same way— and the real problem may be bigger than any of them suspects!

Illustration by Bob Eggleton



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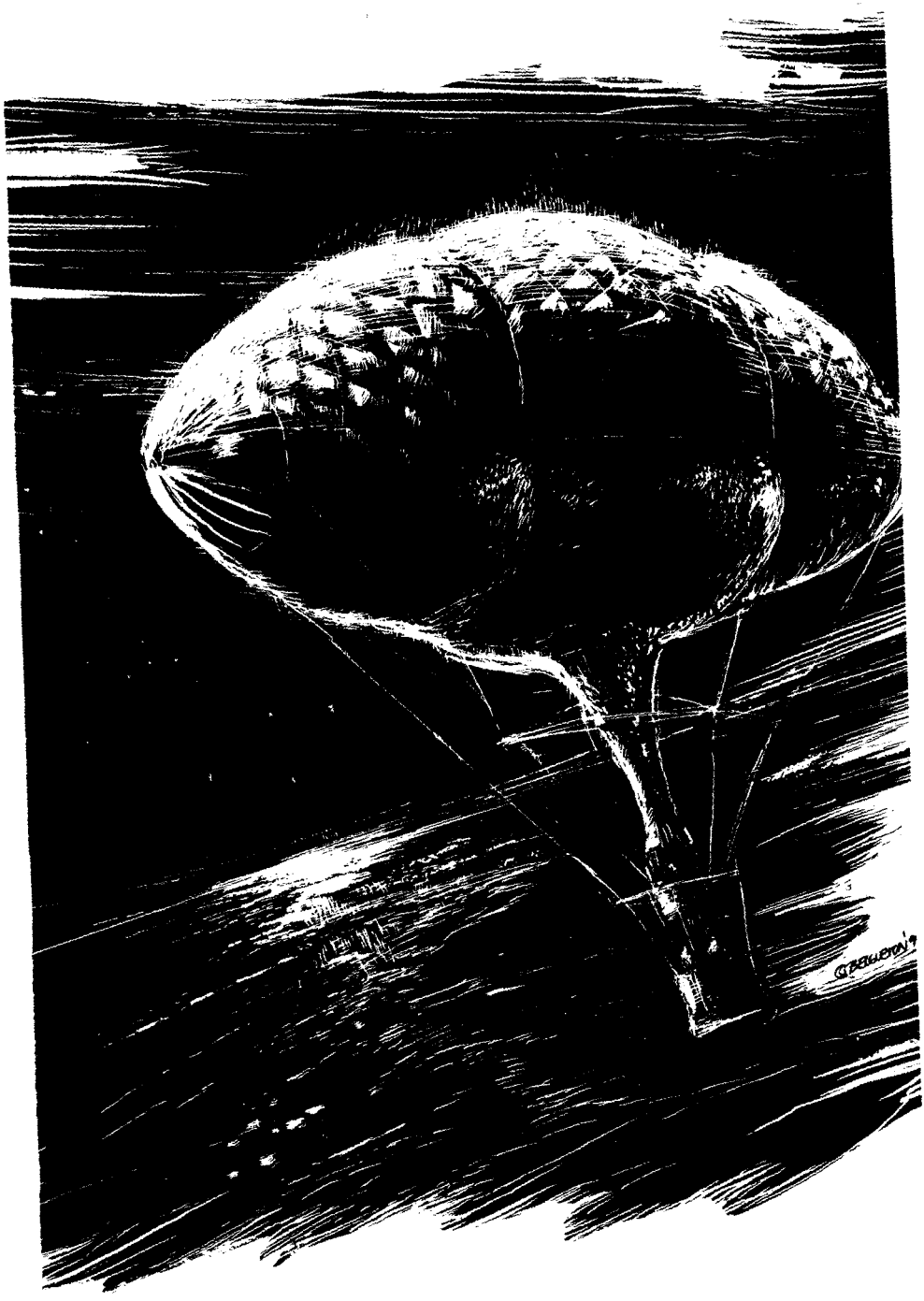

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A stiff west wind punched at the balloon's gondola from below. Rahel grabbed reflexively for the basket's edge, forgetting for the moment that her intellect knew without doubt that the gondola couldn't tip. It was an easy thing to forget this high up, with the wind shoving at her like an ill-trained dog and the night-dark water stretching from horizon to horizon so far below.

She closed her eyes on the glowing grids dancing across her retinas when the tactical display projected there tried to keep pace with the wild changes in her focus. Shutting out the display helped. Still, she waited for the gondola to steady before slipping a hand in front of the projection fiber and opening her eyes to reestablish her bearings.

The Odarkan Sea pooled in the darkness below them like a sheet of still, black metal. Rahel couldn't even hear the lick and slap of gentle water movement, and the normally timid caress of this planet's breezes wasn't nearly enough to raise waves high enough to see from a couple hundred meters up. The only feature distinguishing this placid, land-bound sea from the sloughs around it was an ethereal thread of light stretching like sprinkles of stardust from the water's black center toward where the mother ocean waited in the west.

Rahel realigned the overlay grid with the realtime planet surface, then double-blinked to freeze-frame the image. "Sector 23/26," she said aloud. The computer picked out the individual jellyfish bodies among the long, glowing chain, and she counted them in rapid silence. "Medusae count: forty-two."

Behind her, the click-tapping of pen on notebook screen told her that Paval still stood with his back against the gondola's opposite rail, conscientiously keeping himself both out of her way, and out of the way of the pilot. "That brings our adult total to 115," he reported softly. Rahel heard him log the number along with all the others.

As long as it makes him feel useful. She'd argued bitterly when Saiah informed her she'd have to take an apprentice on this assignment. Whoever the kid was, she'd maintained, he'd just get in the way. He'd be useless for running tests, because Rahel would have to explain every little thing to him instead of just taking the fast route and doing it herself. And he'd be bored doing nothing more than watching her collect samples and count slow-moving jellyfish. And he certainly wouldn't learn anything, because Rahel didn't intend to talk to him.

Saiah had a habit of listening to the opinions of everyone and their mother, though, then doing whatever he wanted. It was part of why he'd survived mentoring Rahel all those years before. "You pay ahead," he'd told her simply. So on departure day she'd reported to the spaceport as usual, and found herself stuffed into a jumpship next to some young outworld Colonist with eyes as round and brown as a puppy's, and a graceful lilt to his accent that would probably tell her exactly where he'd been raised if she cared enough to pay at-

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tention. It would be a long time before she forgave Saiah Innis for this.

"Even on a generous estimate," Paval volunteered from behind her, "115 in our sample alone is a decline of nearly 62 percent since the census last year."

Rahel didn't comment, instead flicking the optic fiber away from her eye so that she could study the seascape below them without the computer grids interfering.

"That isn't enough, is it?"

And here she'd set him the useless task of writing down the numbers because she thought it would keep him too busy to ask stupid questions.

She pulled the phone from her field vest pocket and punched the contact button with her thumb. "Nils?" She heard the other proctor pick up, so didn't wait for him to acknowledge. "What's your total?"

"I've just completed my last sector." His voice over the comm unit sounded flat and thin against the background hissing of wind across his own phone's mouthpiece. "I totaled in at 203."

"That brings us up to 318."

Rahel knew the number even before Paval dutifully reported it.

"That isn't enough." This time the apprentice wasn't asking her. And, no, it wasn't enough.

Rahel turned away from the depressingly empty waters and lifted the phone to her ear again. "OK, bring it in," she told Nils. Across the gondola from her, she could see Paval quietly close up his notebook and slip his pen into its slot. "We'll pick up again in the morning, do another count tomorrow night."

"What? You're actually going to let us unpack and find our sleeping rooms?" Nils's voice danced with feigned surprise. "But, Rahel, we've only been onplanet six hours! You must be getting soft in your old age."

She closed the phone and thrust it back into her pocket.

"Turn us about, then, ma'am?"

"Yes, Jynn." She answered the pilot without really looking at him. He perched, comfortably casual, in the little swing seat half-way up the rigging. She could just make out the lighter patterns on his clothes in the weak moonlight, but couldn't see the features of his black-as-black face at all.

"I can't help but hear all this talk about the jellyfish, ma'am." Jynn's ropes creaked and swung as he adjusted the balloon's engine to ease them back toward the resort. Rahel felt the balloon stutter faintly, but never heard the silent motor engage. "The jellies are going to be all right, aren't they? Mr. Sadena called for Noah's Ark in time, didn't he?"

Paval turned his pale face up toward Jynn and opened his mouth as if to answer. Rahel spoke before her apprentice had a chance to form his first word. "That's something we'll have to take up with Mr. Sadena, Jynn." She caught Paval's eyes when he jerked a look at her, pointedly not letting him go. "Like Proctor Oberjen says, we've only been here six hours. We've still got a lot of questions to answer."

Much to Rahel's surprise, Paval only nodded mutely and turned to

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look out over the water. She could tell by the strength with which he gripped his hands together when he leaned across the rail that he didn't agree with her decision to keep the details from the locals. But he'd listened to her, and done what she said without fighting. For a young man his age, that in itself was a miracle.

Maybe he wasn't so stupid after all.

Even at night, the shoreline of the Odarkan Sea was a riot of organic activity. Fist-sized moths, their wings flashing whitely in the dim illumination, bumbled from treetop to treetop, shore to shadow. Swamp lights licked brief, cold fire against knotted, moss-hung trunks while some slow, nocturnal herbivore splashed its way through the shallow waters. Two hundred meters higher up, Rahel wrinkled her nose against the sharply rotten smell that feathered up from the planteater's footsteps.

The bugs down there must be awful, she reflected, watching the balloon's shadow warp as it passed over the sleeping trees. She hoped they wouldn't have to spend much ground time along the Odarkan coast. Tromping around in outbacks and jungles was one thing; tromping around in fetid, bug-choked sloughs was something else. Rahel had always been sanguine about being killed and quickly devoured by just about any predator she'd ever met. It was the process of being eaten one tiny nibble at a time that wore on her patience.

"If the flying is still making you dizzy, try focusing on objects that are farther away. They parallax more slowly and don't disturb your eye."

That, and having an apprentice.

"Don't you have any background reading to do?" She wished she had some excuse to move over to the other side of the gondola.

"No, ma'am. I've already read everything pertinent to this safari that I could find." He barely stood taller than her shoulder, but massed about the same, with the lean, broad-shouldered build that came on young men who'd spent much of their lives in physical labor. "There wasn't much."

Rahel found herself wondering, much against her will, where exactly he had come from, and what had drawn him to Noah's Ark. "Well, call up some of my old stuff, then. It'll save me from having to lecture you."

"I did that before I came." Paval angled a polite but meaningful look up at her. "There wasn't much of that, either."

Rahel allowed the boy a thin smile. "Is that a coward's way of asking why I haven't published my research?"

She was surprised by the chase of color up his pale cheeks. "It was an observation."

"Well, damn fine observation." She clapped him smartly on the back and earned a startled jerk of his shoulders in response. "Keep up the good work." The next time Saiah Innis assigned her an apprentice, she was going to kill someone.

"Jynn." Distracted briefly by the wall of darkness rising up from the approaching horizon, Rahel took one blind step backward before turning to face the balloon's pilot. "When we

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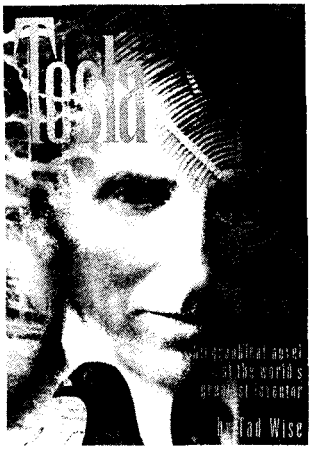

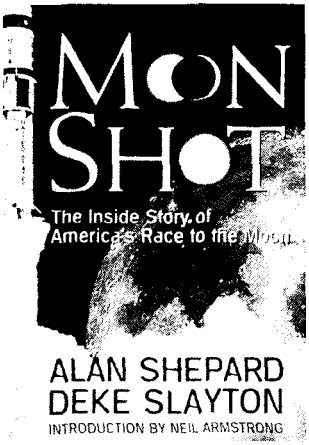

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get back to the hotel, can you set us down near our pachyderm so we can off-load our gear?"

She heard the shushing of the gondola's ropes more than saw the pilot shake his head. "No, ma'am. I can set down on my assigned landing pad on top the hotel, but nowhere else. Them's the rules."

And, Rahel had to admit, Feles Sadena was laudably anal about enforcing his resort's many rules. It was the only thing that had impressed her about him so far.

"The staff will have transferred your things to your suites by now, anyway, ma'am," Jynn continued. A roar of flame and light suddenly painted his figure in shades of stark mahogany as he gassed the balloon upward a few more meters. Then he vanished again as mysteriously as he'd appeared. "With a full season staff and no guests to look after, it's all any of us can do to keep busy. You'll probably be getting top drawer service while you're here."

"We're here because Uriel's suffering a marine die-off, Jynn. We won't be doing much relaxing."

"No, ma'am." He sounded subdued, and sadder than she expected. "I guess not."

A fragile thread of breeze met them at an angle, and Rahel turned to taste the salty freshness of its passage as Jynn tacked expertly across the wind's light current. The second balloon, with Nils's thin silhouette propped against the rail of its gondola like a leaned-over stick, slipped through the strait just ahead of theirs. Rahel watched it drift oceanward as silently as a dandelion puff before a tiny jet of light nudged it ever so slightly about and pointed it back in toward shore.

The walls of the strait draped shadow over Rahel's swinging gondola when Jynn ducked them just as neatly between the coarsely wooded slopes. Clean, moving air replaced the stagnant bite of the margin sloughs, and the kiss of three dim, distant moons stitched trails of broken silver across the rippled surface of the open ocean. Rahel reminisced wistfully about the cries of diving ocean birds, the crash and sigh of tidal currents. Uriel's tiny moons and greenhouse atmosphere had its disadvantages, as well as its pleasures, though—the people who came here paid for the temperate climates by giving up natural wildness and power. Which was perhaps just how they wanted it. Rahel found the end result charming, but rather dull.

The beach separating ocean from shore was narrow and mud-draped, as befitted a planet with no tropical storms or wave erosion to speak of. A long expanse of pale carbonate rock peeped out from a weep of gauzy fronds, following the shoreline as smoothly as a line drawn in the sand, while a glossy drizzle of seep water painted the outcrop's face in trickling crystal. It wasn't until Rahel glimpsed the unshielded white of their pachyderm on a high, wide ledge that she recognized this rock face as the frontispiece of the Startide Hotel. Then a weird mixture of guilt and anger coiled together inside her, and she scowled against the unwelcome taste.

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Just like all of Sadena's resorts, the Startide seemed to have grown out of the environment by its own volition. There were seven others just like it scattered all around Uriel's surface —among the hushing grasses of the great northern plains, suspended from the tree trunks in the equatorial woodlands, clinging to the slopes of youthful mountains so tall that the snow on their creased brows created its own mini-climates. Rahel remembered reading all about Feles Sadena's brilliant plans for this place when he first bought the planet. How he was going to minimize impact. How people would be able to come experience nature at its purest and best. How the planet's unique environment would itself be the attraction, and therefore more precious than any manmade commodity Sadena could introduce.

Rahel had thought the man a schlockmeister from the very beginning. She hated it that Sadena's only appreciation for what he had here was based on how much money it could bring him—hated it even more that no altruistic organization had ever succeeded in preserving an environment so thoroughly or so well. When Feles Sadena finally closed up his enterprise a hundred or so years from now, nothing on Uriel would be different for him having been here.

Well, almost nothing. Rahel thought about the stellar jellyfish, and couldn't silence a brusque, ironic sigh. It seemed both fitting and somehow hopelessly tragic that the first casualty of Sadena's hubris should be the very species of coelenterate that kept the Startide Hotel full of tourists.

Hot wind roared out their balloon's out-gassing vent, and their gondola dropped with a barely perceptible lurch. Rahel clenched her hands, panic tight, around the rail. It wasn't the height, she decided grumpily, it was the goddamned unsteady flight patterns she hated so much about these balloons. Maybe something resembling outdoor lighting on the roof of the hotel would prop up her confidence about landing, at least. She suspected nothing would alleviate the roiling in her stomach whenever a gust rocked the gondola and showed her ocean when she should have been looking at sky. If only because of the modes of transportation, this was going to be one very long safari.

"What the—?"

Jynn's startled shout was his only warning before a blast of light lashed and curled through the humid darkness around them. Rahel ducked away from the flame, throwing out one arm to corral Paval against the railing when he turned to do the same. Below them, movement seethed across the hotel's flat stone roof, an amorphous creature of shadows and angry voices. Then the gas driven upward by Jynn's flame swelled the sinking balloon and stopped its descent as surely as if the craft had hit the end of some invisible tether. Rahel pushed herself upright and leaned to look over the railing.

"They're all over my landing pad!" Jynn complained, fighting with the balloon's controls. His straps and harnesses squeaked and jangled.

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Rahel blinked hard through the renewed darkness. Shapes refused to define and let themselves be identified, but the braided stream of questions and netlink IDs sketched out clearly enough what was going on below. "Ah, shit. . . ."

"What?" Paval appeared beside her, leaning so far out of the gondola that she had to quell an urge to grab him by the belt and haul him back in. Even from her more judicious position, Rahel saw the earnest frown that knotted his dark brows. "Who are they?"

As if Nils had heard them from a whole other balloon away, the phone in Rahel's pocket chirped. She dug it out with an irritable sigh.

"Oh, please," Nils groaned the moment she opened the contact. "Please tell me those aren't what I think they are."

Rahel scowled down at the mass of shouting people. The first waspish whiz of remote antigravs joined the babbling voices. "Well, they aren't bellhops."

"They're reporters!" Paval, still folded nearly double over the gondola's rail, had to jerk himself upright to avoid colliding with one of the fist-sized minicams. It buzzed into position an arm's length from him and activated its seeker light.

"Reporters?" Jynn had finally succeeded in hovering them just a little farther above the crowd than stones could easily be thrown. He obviously hadn't counted on self-guided spybees.

"Either that or a Noah's Ark fan club." Paval swatted at two other whining remotes, to no avail. "How did they know we'd be here?"

Rahel barked a laugh, the phone resting against her shoulder. "Are you kidding? Reporters invented snitches. They can find out everywhere we go." Although why they'd chosen here out of all the active Ark contracts was as much a mystery as anything the press did.

"Perhaps they're here to help us."

Rahel couldn't help laughing at the sincerity of her apprentice's suggestion. "You really are new to this, aren't you?" She picked up the phone again without waiting for Paval to answer. "Nils, hit your lights. I want to get a good look at them."

Almost immediately, a fat finger of light dashed through the darkness to splash against the roof of the hotel. Rahel felt their gondola tip gently as Paval leaned over one section of railing to activate their own powerful lamps. The crowd on the roof recoiled from the light as though they'd been doused with water, then poured back across the open landing area the moment they realized there was no danger. Their swarm of little remote bees echoed their movement.

Rachel cocked a look at Jynn. "Take us down a little closer."

The pilot sighed unhappily, but out-gassed the balloon with a barely perceptible hiss.

There weren't as many reporters on the pad as Rahel had first envisioned. A couple dozen, maybe, with that many again in hotel personnel trying to ring around them and keep them together—as if there were still guests in the resort who might be bothered by the shouting. The amoe-

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boid gathering was the usual motley collection of suits, notepads, and budget-cloned faces. What did the netlinks do to get so many different representatives who all looked almost exactly alike? Rahel used to think they were all VR sims from the same length of flatscreen footage. She wasn't sure it was worth trading her enlightenment on that point for proof as graphic as what shouted at her from below.

Crossing her arms, Rahel leaned her elbows on the rail and peered down at the jostling reporters. "You know," she called, making a try at sounding amiable, "I could probably spit on you from here."

An impassioned plea for attention surged through the gathering, as if her words had been the sweetest encouragement to each and every one of them. Rahel caught a few broken question fragments and a confusion of overlapping accusations, but nothing that sounded like she wanted to answer it. When a voice finally sorted itself from the general tumult, it was from a tall, brown-skinned man at the very edges of the knot.

"Proctor! I'm Cek Lencel, Instant News Service!" He tried to push past the chain of hotel security, squinting up at the balloon with one hand over his eyes. "Why is Noah's Ark involving itself with a management problem on a planet owned by someone other than the Ark?"

Rahel opted not to dim the floods. "Why do you care?"

Lencel tipped his head in surprise. "The news netlinks care about everything."

Yeah, right.

That comment somehow invited another eruption of shouted questions, and Rahel had to straighten up off her elbows to bellow loud enough to be heard over the noise. "Yes, Feles Sadena owns this planet. But Ark policy doesn't limit us to trouble-shooting only in Ark habitats. If the private sector needs our engineering and research services to help manage *any* native environment, Noah's Ark doesn't think granting them that help is inappropriate."

"Nicely said," Nils purred approvingly across the open phone line. Just as well—it was the only piece of Noah's Ark PR she knew by rote.

"Valhanryn Esz, *Tomorrow Today.*" This time it was a woman, too bunched up against the mass of hotel folk to be picked out of the chaos. "Does that mean Noah's Ark isn't accepting any fiduciary compensation for your appearance here?"

"I guess it always comes down to that," Paval remarked, quietly enough to reach Rahel's ears but not the reporters'. He may have been an unasked for burden, but at least he caught on fast.

"That's what I hate about you netlink guys," Rahel answered the reporter. It took more control than she expected to keep from dropping things down onto their thick, news-gathering skulls. "No matter what I say, you're going to make it mean whatever you want it to."

Esz nodded blandly and buzzed her minicam closer. "So you are being paid."

"Rahel. . . ." Nils's voice squeaked

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from the phone waiting down near her waist, "I think I should attack this subject."

But she'd already told them, "Yes," as flatly and noncombatively as she could. They all bent to their respective recording devices before she even started her second sentence. "Mr. Sadena is paying Noah's Ark a consulting fee commensurate with what we've been paid elsewhere for similar environmental impact studies."

"So it is not uncommon for Noah's Ark to produce planetary reports to the specifications of private buyers?" She couldn't even tell which bozo came up with that one.

Rahel smacked a hovering spybee away from her face. "Who told you that?"

"Well, you are accepting a great deal of money *from* Feles Sadena to produce a report *for* Feles Sadena, aren't you?"

"The company I work for is accepting the money." The act of sounding so gracious and patient made her teeth hurt.

"Oh, and that couldn't possibly have any effect on how you choose to interpret the data you collect?"

She clenched her hands around the open phone. "It never has before."

Nils groaned through the phone channel into her palm.

"Will you be working directly from Mr. Sadena's samples and records?"

"Who will you be reporting to?"

Rahel gave up trying to sort out the voices from the crowd. "We'll be conducting our own research—*privately*—and reporting back to both Mr. Sadena and the Ark as information becomes available."

"Then will Mr. Sadena be deciding in which locations you'll focus your search?"

She shrugged. "Why should he?"

"He has some pretty strong incentive to prove he *isn't* destroying Uriel's jellyfish, doesn't he?"

"Look. . . ." Rahel slapped at another roving minicam, missed, then nodded a terse thanks to Paval when he used the offline notebook to whack it out of the air. "Whatever Feles Sadena's reasons for calling Noah's Ark to Uriel, they don't change the fact that *our* reason for being here is—"

"Monetary." Someone different—a woman with the raw, unpolished look of a professional believer—pushed forward from the outermost edges of the crowd.

Rahel bounced the flat of one hand against the railing. "It's not!" She already hated the young woman's coolly crossed arms and well-cut green suit.

The reporter's short-short hair flashed like polished silver when she shrugged. "You said Sadena's paying you."

"That isn't the point."

"That's entirely the point." She stalked to stand directly beneath the balloon, and Rahel suddenly realized from the ripple of attention that followed her that everyone else was eager to lap up whatever blood this young woman could draw. "As long as you're making a profit off your so-called scientific interests, proctor, you've got no right to stand here and

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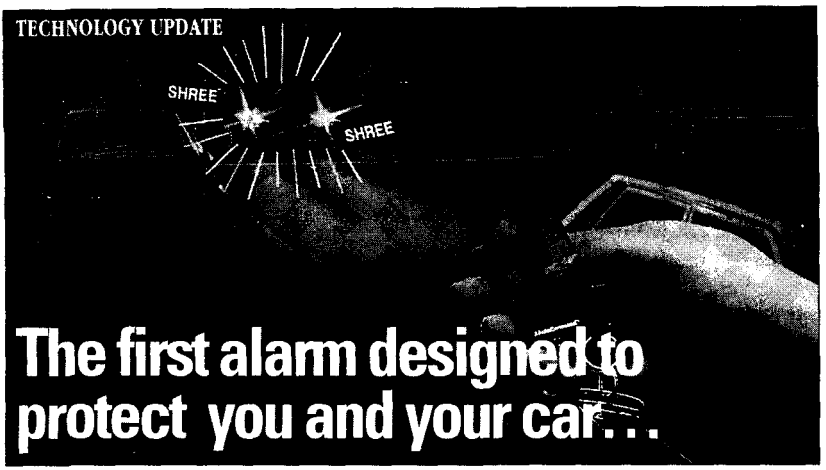

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by Charles Anton

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claim you're any different than this tourist trap. Both of you exploit some aspect of Nature for your own purposes."

Rahel wished she were on the ground, face-to-face with this self-appointed moralist, or at least in range to grab and shake her pressed lapels. "What's your name?"

The reporter cocked her chin up with easy pride. "Eme Keim."

"From GreeNet," Rahel finished for her, and Keim's only answer was a twist of her mouth that didn't resolve into any particular expression. Rahel allowed herself a derisive snort. "Well, guess what, Eme Keim? Science takes money. Do you think Noah's Ark can just clone credit, the way we do the animals?"

"Rahel. . . ." Nils's warning trickled up like smoke through the still-open communications line.

"If we had endowments from every planet in the goddammed sector, we *still* couldn't pay for the time—"

"Rahel!"

"—The food, the resources, the land—"

"Rahel!"

The bark of his voice leaping the distance between balloons caught her attention, and Rahel jerked an angry glare across the dark at Nils. He scowled back, just as fiercely, as though trying to mentally convey some message through the sheer force of his stare. Rahel clapped shut the phone in her hand in petulant dismissal.

If the gesture meant anything at all to Nils, he ignored it. Slipping his own phone into a pocket, he leaned over the edge of his gondola to address the reporters. "Excuse me, ladies and gentlemen." The group as a whole inclined heads to peer at him, and Nils smiled coolly. "I'm Proctor Nils Oberjen, Proctor Tovin's associate and counsel. I would be more than happy to explain the public particulars of Noah's Ark's contract with Mr. Sadena to you, but not from up here. I have traveled twenty-seven light-years, spent two days in a jumpship with my colleagues, and have neither bathed nor eaten since arriving on Uriel. If you'd like to have your curiosity satisfied, kindly let us set down and tend to our creature needs first. Perhaps we can talk in the morning."

"No."

Nils twitched upright as though he'd been poked in the ass. Rahel would have given anything to have a clearer view of his face just then. Maybe this would teach him to trot out his juristic bullshit for the media.

"You're not the only one to spend a lot of time and money getting here," Valhanryn Esz told him prissily. "We've been standing in the cold for four hours, waiting for you to get back from your sightseeing. Now, you're either going to answer a couple of questions, or you're not putting down." Her colleagues hooted and whistled their support, and she glanced around her with obvious pleasure. "That's the deal," she said at last to Nils. "And I'm afraid it's not negotiable."

Rahel snorted, and the reporters all glanced up at her as though they'd forgotten her presence. "I've done barter with the mazhet," she told

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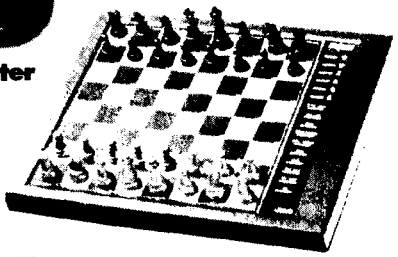

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them, scowling. "Everything's negotiable." She nodded brusquely back at Jynn. "Set us down."

The pilot's eyes flashed white in the darkness. "Ma'am?"

"I said set us down." Rahel grinned maliciously over the railing at the unsettled crowd below. "The only thing netlink parasites care about more than their headline grabbing is themselves. They'll move."

Jynn reached uncertainly for the descent controls above his shoulder. "And what if they don't?"

"They'll move."

The first blast of outrushing gas gained a haphazard rumble of surly protest from below, then a more directed cry of alarm when the first reporter realized the balloon was descending rather than going away. People and spybees scattered from beneath the gondola like pigeons. Rahel heard Nils moaning something about "reckless endangerment" and "litigious barbarians," but she had learned long ago not to take his displays of anxiety too seriously. By the time their gondola bumped to rest on the smooth pavement, only Keim still stood close enough to clap hands on the rail and nod thoughtfully.

"Force." The GreeNet envoy very pointedly held her ground while Rahel swung one leg over the railing and started to climb down. "Very environmental. Very subtle."

"You've probably heard. . . ." Rahel turned to accept the pack of field equipment Paval passed down to her. "Subtlety isn't my strong suit." Her apprentice followed her in silence, avoiding eye contact with the reporters in a way that could have meant either great annoyance or embarrassment. Rahel couldn't tell which, but suspected both were as likely.

"If I were you," Keim suggested, "I'd work on the subtlety thing. You could have killed somebody here."

Rahel smiled and shouldered her pack with a shrug. "You're not part of the native environment. Why should I care?"

The Newborn robot who staffed the main lobby crouched behind the desk like a blue and silver crab. Rahel guessed it as an old construction mech, judging from the collection of arms and spare arm sockets bristling from its stumpy body. Probably a foreman or it never would have developed enough awareness to petition the courts for sentient status. Someone had done a bang-up job refitting its chassis to match the Startide's glass and aquamarine decor, even down to replacing the lenses in its optics with varying shades of blue and turquoise crystal. The hotel designers had even granted the Newborn a certain sense of freedom by hiding its necessary monofilament track in the sweeping kelp-frond pattern of the white-and-green tile floor.

There was obviously something for everyone at the Startide Hotel—whether you were human or not.

"Well," Rahel stopped just inside the landing pad doorway and dropped her luggage with a sigh. "I guess no one can fault Sadena for accommodating non-human personnel."

Paval glanced up from setting

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down his own small roll of luggage, turning a look over one shoulder to note the Newborn at its slightly-too-short registration desk. "I wonder how well he treats his human personnel." Then, seeming suddenly to realize how impolite that sounded, he pushed their field pack together with their gear and volunteered curtly, "I'll go get the keys," before Rahel could say anything to reprimand him.

Not that she'd intended to. She watched him cross the spacious lobby at a brisk trot, and wondered if Saiah had forced an apprentice on her because he thought it would be just like having another puppy. If only apprentices had such short childhoods and were so easily trained.

"Thank you so much for waiting to make sure the media didn't rend me limb from limb." Nils came up on her from behind, his footsteps characteristically unhurried even though he carried nothing but a pocket notebook and a single overnight valise. "Really—thank you."

Rahel glanced back to find him completely unscathed, his valise balanced neatly atop Rahel's equipment pack. "A lawyer as slick as you, Nils? I thought that was why the Ark sent you."

"And with your skills at client relations, Rahel, it's a wonder they even considered me."

Not in the mood for Nils's verbal sparring, Rahel leaned back against a nearby pillar and watched the fish in one of the self-sustaining tank colonies. They looked as confused and unhappy with their artificial surroundings as she.

"Anyone up for dinner in the Galaxy Ballroom?"

She looked up as Paval approached, and Nils lifted red-gold eyebrows with interest. "Are you paying?" the lawyer asked.

Smiling, Paval handed Rahel her flat plastic key with one hand, offering a similar card to Nils with his other. "I don't think anyone working for the Ark makes enough money to afford it." He fished in a front pocket of his field vest and withdrew a crumpled square of paper between two fingers. "Huan gave me this when I picked up the keys."

"Huan?" Rahel twitched the paper away from her apprentice, just out from under Nils's reaching hand. Nils returned his hand to the top of his suitcase with quiet aplomb, too well-bred to bicker.

"The Newborn running the front desk." Paval retrieved his own bag and shrugged it over one shoulder. "He's our concierge and guest liaison while we're here."

Must be easy to lavish attention on hired researchers when the rest of your resort is shut down. Rahel spread the paper flat with one hand, and didn't even object when Nils leaned over her arm to look at it with her.

My apologies for the disturbance upon your arrival this evening.

Please help yourself to any dinner on our menu with my compliments. I will be honored to join you at my earliest convenience.

F.S.

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"We've each been given a private suite, too," Paval went on when Rahel grunted and pushed the note aside to Nils. "Huan said if we need anything, all we have to do is let him know. This place has everything!"

Which Rahel suspected was rather the point.

"I think I need a swordfish steak and at least a half a bottle of good Terran wine." Nils picked up his valise and looked speculatively from side to side. "Not to mention a bellhop to take our things to our rooms so we don't have to be bothered."

Rahel stooped with a disgusted snort, sweeping up her bag and her field pack one in each hand. "I think you guys need to remember what we're here for." She glowered at both of them, but only Paval had the grace to look subdued. "Not only is Feles Sadena probably responsible for the very disaster we're trying to avert here, but running up expense tabs with big rooms and fancy food isn't why Noah's Ark hires out its services to private sectors. Or weren't you listening to all that yelling a minute ago?"

Nils made a face at her, waving Paval into silence when the apprentice opened his mouth as though to defend them. "The boy and I are quite aware that we aren't on Uriel to enjoy ourselves. But does that make it wrong to take a little pleasure when it's offered?"

"I'm sure that's what everybody who comes here says." Rahel turned away from them with a scowl and a dismissive shake of her head. "I just think maybe you ought to consider what made them have to call us here in the first place. That's all."

Rahel's suite took up half the sixteenth floor. It smelled of sea sand and hyacinth. She dropped her luggage, then danced a few steps forward when the door tried to slide shut on top of her. The instant it hissed into its frame, she wished she could duck back outside again.

She didn't want to stay in a place like this, a place where live sea plants were confined to water-filled cylinders all for the sake of decoration. A place where nudibranchs and *Aequorea* were depicted as often in the furniture carvings and artwork as any native Uriel species. What Sadena advertised throughout the Galaxy as an homage to the natural world was a sham, constructed to look and sound and feel the way wealthy tourists expected it to, not the way nature really designed it. Just like the Startide's carefully downplayed frontispiece, and the spectactular robotic arthropod running the desk in the lobby.

Kicking her luggage to the foot of the bed, Rahel walked slowly across the opulent sleeping area, past the coffee table with its tangle of blooming plants, and tapped a hand against the floor-to-ceiling window that made up the suite's outside wall. Whether honestly or through some trickery of remote projection, she was rewarded with a stark, nighttime vista built all of ocean, starlight, and in-rolling clouds. Already the farthest strip of sky looked like nothing but a blurry black smear where encroaching weather smothered the

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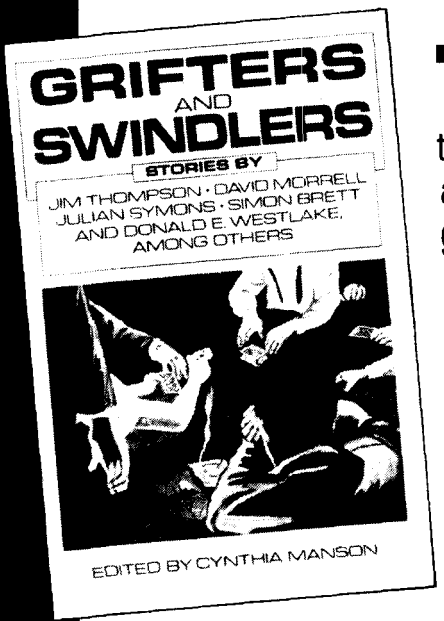

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horizon line and smudged out the stars.

Held up against the manic complexity of Sadena's elaborate hotel, Uriel reminded Rahel of a chicken's egg subjected to comparison with its brighter, augmented Fabergé cousin. It didn't reassure her that the one humans would pay millions of credits to preserve was not the one still containing all the subtle chemistries necessary to create life. Somehow, work done by human hands always impressed the masses more than anything done by nature, even when man was only copying what he'd already seen. That's why Uriel needed a series of resorts in the first place—to make sure her natural splendors weren't "wasted" on her own non-sentient inhabitants.

And Saiah wonders why I hate these jobs.

No, come to think of it, he probably doesn't.

The bathroom was dressed all in polished coral—taken from the oceans back home on Terra, no doubt, since Sadena found Uriel's environment far more valuable intact that it could ever be piecemeal—and the bed was a floppy monstrosity of water and pre-warmed silk. Sweeping off the shimmering turquoise comforter, Rahel stripped both pillows of their shams and carried the bundle to the sitting area and the big clear outside window.

One end of the window, captured behind a length of velvet sofa, slid open almost as wide as Rahel's hand—enough to let in a maddening whisper of ocean-fresh air, but not enough to let any heartbroken fool fling himself out onto the driveway. Just as well. It would have been awkward to explain how she ended up in the front lawn planters if she happened to roll over in her sleep during the night.

Stuffing both pillows and comforter onto the floor beside that crack, Rahel climbed down the immovable sofa and wrapped herself awkwardly in the shiny, slippery turquoise blob. The oceans on Uriel may have been quiet and shy, but at least she could fall asleep to their voiceless rhythms, not to the manmade silence of facile creature comforts and white, confining walls.

The next morning arrived in a haze of humid confusion. Rahel passed her flippers from one hand to the other in an attempt to get a grip on the equipment pack sliding off her shoulder, but still ended up trotting down the last of the Startide's front steps with the pack swinging heavily from her elbow. Behind her, curses and complaints ricocheted within the wall of reporters that hotel security manfully pressed back toward the edge of the staircase. Rahel tossed the guards a mental thanks for their efforts, but didn't slow down to actually say anything. She didn't have time.

Rahel hated being late. There was nothing deep and psychological about it as far as she was concerned, just simple annoyance for the loss of time mixed with some self-flagellation for being too stupid to pay attention to the time. The morning spent studying details of the stellar jelly

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lifecycle of eggs, larvae, and breeding stalks had seemed like such a good idea when she'd sat down to it at dawn. Now—her mind sloshing about with data on spermatozoa, hydroids, and single-celled offspring—she wondered if she wouldn't have done better to sit down here on the docks to do her reading. At least then Paval would be the one feeling foolish as he hurried to join her, and not the other way around. She shrugged her pack up over her shoulder again, and resisted the urge to break into a trot when she reached the dock at the bottom of the stairs.

Paval jerked a look back at her when the vibration of her footsteps reached him, and Rahel was surprised by the eager hope that flashed in his nervous smile. Maybe the slim, bald pilot hovering at his side was getting too friendly for Paval's comfort. Rahel had no idea what kind of cultural taboos the boy labored under. Early morning crankiness made her toy with the idea of slowing her stride (just to see what would happen), but she resisted in favor of finding something more constructive to do with her mood. When Paval abruptly disengaged the pilot to hurry toward the skate at the end of the pier, Rahel was just as glad she hadn't dawdled—the face that turned to watch her approach didn't belong to a bald skate pilot after all, but, rather, to netlink ferret Eme Keim, with her androgynous clothing and too short blonde hair. The pilot, apparently, was the steel-and-teflon robot bolted to the skate's navigation console. Rahel suddenly wasn't sure what to expect from this morning expedition, and that spurt of uncertainty made her stomach burn.

"Proctor Tovin." Keim said it half as greeting, half as identification as Rahel walked into easy speaking distance.

Rahel passed her by without slowing down. "Some reporter you are. What were you doing talking to him?" She waved at where Paval fidgeted with one leg already in the waiting skate. "He doesn't know shit."

"I'd assumed as much." Keim fell into step behind her, unperturbed. "Mostly, I was waiting for you."

"I don't know shit, either." Rahel tossed her pack at Paval. "Talk to me tomorrow."

"I don't know that I'll be able to get permission again tomorrow."

Rahel paused, one hand still on the dock piling, and turned slowly to cock a suspicious look at Keim. "Permission?" Behind her, Paval groaned.

"I know you won't believe it, but this wasn't even my idea." Coming a few leisurely steps closer, Keim presented a folded slip of paper. "The memo I got this morning said I should give you this if you made trouble."

Rahel plucked the note away from her without shifting her scowl from Keim's pert little smile. The faintest tickle of pleasant sweetness danced counterpoint to the smell of ocean when she spread the note open against her palm. The scent dissipated before she could identify what it was supposed to remind her of.

Feles Sadena's already-familiar script decorated the paper with hair-like grace.

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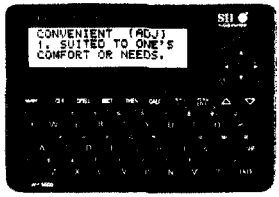

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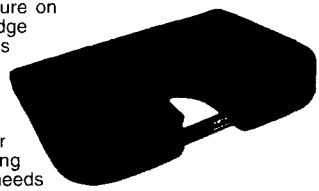

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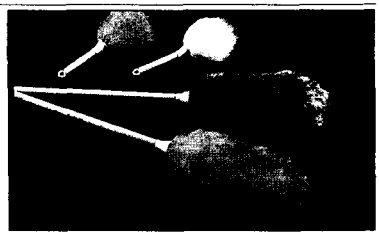

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Proctor Tovin—

Forgive my presumption in arranging this interview with Ms. Keim. I have paid generously for your presence on my planet, however, and so I feel I have some liberty in interpreting the particulars of your duties here.

I would very much like to see at least one of the netlink services produce a truthful report of our efforts on behalf of the stellar jellyfish. With that in mind, Ms. Keim of GreeNet has been granted permission to accompany you on today's expedition. You do not, of course, have to answer everything she chooses to ask you, but I needn't remind you of the benefits of positive publicity.

Thank you for your cooperation in this.

F.S.

Cooperation. He obviously didn't know her very well.

"She showed me that, too."

Rahel hadn't even heard Paval move up behind her, and so shot him a sharper look than she'd really intended.

His attention, however, was focused on Keim. "Do we really have to bring her with us?" he asked quietly.

Rahel shrugged. "Did Sadena say anything about this during dinner last night?"

"He never even came to dinner last night." She couldn't tell if Paval's disgust was aimed at Sadena or the reporter.

"Well, then . . ." Rahel made no effort to keep her own voice down, "we could always push her off the pier."

"And she'd write all about it in her netlink upload tonight." Keim returned Rahel's glower with an angelic grin. *A Greenie,* Rahel reminded herself, *and a smartass.*

"Remember that skinny little redhead who came in with us?" Rahel rolled Sadena's note into a ball between both palms. "Well, we brought him along to talk to people just like you. Why don't you go bother him?"

"Because I'd rather talk to the people who are doing the real work," Keim told her, stepping down into the skate beside them. The boat listed drunkenly under her added ballast, and Paval scooted hurriedly to the other side to try to even them out. "Not to the people with the pre-prepared answers who were sent to stonewall the people like me."

As much as Nils would have accused her of not understanding politics, Rahel had to admit that she knew enough to know that pissing off both the Ark's employer and a major netlink news correspondent in one fell swoop wasn't a very good idea. She just wished she could shake the feeling that Nils would have found some incredibly smooth way to convince Keim she'd rather count sea gulls from the docks. She jerked loose the closest tie-off, and turned away from the reporter with a growl.

"You got extra UV block?"

Paval looked up from strapping on his flippers with sharper, shorter motions than really necessary. "Me?"

"You?" Rahel parroted, not in the mood for anyone else's ill temper but her own. "The man without a molecule of melanin in his dermis."

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He pursed his lips and bent back to his equipment. "I'm already covered up." This despite the fact that his cheekbones and nose already looked pinkish above the bright yellow-and-black Ark skinsuit. Or maybe that was just a trick of the strong greenhouse sun.

"Not for you—" The skate's antigravs cut in with a kick, and their rise to a meter above the water made Rahel catch at Paval's shoulder when she leaned over him to jerk his pack out from under his seat, "—for her." She found a tube of UV screen jammed under a clutter of sampling vials and a flimsy on skinsuit prep. "If she sunburns while she's out here, she'll probably blame that on Noah's Ark, too."

Rahel turned to find Keim sitting awkwardly on the floor of the skate. It soothed her irritation a little to see the faint startlement in the reporter's eyes as the skate crept silently up to speed. She held the UV block in front of Keim's face, then sighed when the reporter didn't immediately reach for it.

"You've got less than thirty minutes before me and my partner dive overboard and start getting down to that 'real' work you mentioned." Rahel caught at Keim's wrist and unceremoniously clapped her hand around the UV tube. "So if I was you, Ms. Keim, I'd start talking."

Sunlight, bright as fire on glass, exploded across the water around them as the skate slipped northward out from under the shoreline shadow. Rahel squinted despite her sun visor, and heard Keim groan against the sudden intensity before Paval relinquished his own eye protection—for the sake of the Ark's reputation, no doubt. She wished now that she'd thought to bring along extra visors, and couldn't help burning with renewed annoyance at the reporter. Then they passed out of the shallows and the skate leapt into speed, leaving hotel, reporters, and frustrating hindsight doubts all behind.

Rahel hadn't expected the hush of the skate's low-friction sprint. She gripped the edges of her seat even though they streaked toward the Odarkan straits in a smooth, unnatural rush—no bobbing with the windy chop, no needle stings of water against her face or the exposed backs of her hands. The only wake behind them was a dotted trail of foam divots where wave crests were brave enough to brush at the stern of the boat as it raced by.

Rock clambered up from the water on either side, rising high and fast to build the ragged straits that marked the entrance to the Odarkan Sea. At the stately drift of a hot-air balloon, the throat of stone leading into the Odarkan had seemed long, and wild, and elegant. Now, it tore past too quickly to register as anything but a sketchy frame for the view of dawn-bleached mist and distant woodland. Then the fleeting sense of confinement whisked away, and the only thing Rahel could see besides the hectares of sun-splashed water was the smudge of border trees with their false rootwork of blurry swamp reflections.

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"You've got to be making this up."

Rahel tore her gaze away from the slough's bleak grandeur, and sighed. Keim had actually been quiet for nearly two minutes now, paging back and forth through screen after screen of scribbled notes. Rahel had rather hoped the reporter's silence meant she couldn't think of any more annoying questions. So much for that.

"You think I have nothing better to do than make up stories for gullible netlink Greens?" Rahel asked her, turning forward in her seat. At the front of the skate, their boxoid pilot remained fixed and unmoving as it manipulated the boat's many controls in eerie machine silence. Paval, sitting one seat behind the pilot's position, swore that the steel-grey construct was a Newborn. Rahel hadn't bothered to crawl forward far enough to read the designation on its Robot Identification tag. "I can't believe your net sent you out to report on something you obviously know nothing about," she continued to Keim.

"I know enough," Keim said firmly, not looking up from her notes, "to know that stellar jellyfish do not come from coral."

Rahel growled and tugged at her forelock while Paval stated in a slow, loud voice, "Nobody said they *did* come from coral."

"Stellar jellyfish make eggs." Rahel bent forward to lean her elbows on her knees, ticking off elements of the life-cycle within a few centimeters of Keim's humorless scowl. "The eggs hatch into larvae, which swim around until they find some nice rock to latch onto. Once they attach, they grow into polyps—"

Keim flipped her notebook and stabbed at an entry. "Which is a type of coral!"

"Which is *like* coral!" Paval corrected, and Rahel grumped over him, "Sort of!" before Keim could take that as some kind of justification for whatever she'd written. "After the polyps have been around for a while, they start shedding single-celled ephyrae, which eventually grow into adult jellyfish. This is such an effective system that it's existed essentially unchanged for about 600 million years both here *and* on Earth. It's partly because we've never had a chance to study such perfect parallel evolution in such a high-level organism that the Ark was interested in taking this job."

Keim flicked a look at her over the top of the notebook. "Jellyfish are a high-level organism?"

Rahel shrugged. "Compared to slime molds, they are."

"So does Mr. Sadena know that Noah's Ark has ulterior motives for being on Uriel?"

Rahel fought down a prickle of annoyance even as she saw Paval jerk his head up sharply in the seat behind Keim. "Not ulterior. Just more complex, maybe."

"So you acknowledge that the well-being of the stellar jellyfish population may not be Mr. Sadena's primary interest in engaging Noah's Ark."

This time it was clearly a statement. Rahel clenched her hands together into a fist.

"I can only tell you why *I'm* here, Ms. Keim," Rahel answered stiffly. "If you want to know what Mr. Sadena

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is thinking, you'd be better off taking it up with him." Nils would have been so proud.

"Oh, come *on.*" Keim dropped her notebook against her knees with a *clack!* "Are you actually going to look me in the face and tell me you don't care why he really brought you in?"

What a stupid question. As if Rahel's caring could change one damn thing the man had done to this planet. As if Sadena's dissembling could change how much she cared even so. "I don't care," she told Keim simply. It wasn't exactly the first time she'd lied to the press.

Keim made some mark in her notebook, face calm but cheeks faintly red. "Don't care that Feles Sadena is using Noah's Ark to whitewash his poor management of this ecology?" she asked in studied sincerity. "Or don't care that even GreeNet doesn't believe you'll be allowed to tell the truth in your report, much less accomplish anything with it?"

Something about the way Keim waited with her stylus poised above the screen as though expecting some sort of straight answer made Rahel smile. "Let me tell you something," she said, pushing up from her knees to lean back in her seat again. "No amount of money can change the facts of a scientific investigation. Whatever Sadena *thinks* he's paying for, Noah's Ark is here to find out the truth about what's going on with this environment. Paval and I—" She waved at her apprentice over Keim's shoulder, but the reporter showed no inclination to glance at him, "—are the first phase in what will probably end up being a very lengthy planetary study. But for right now, we'll check out the immediate complaint, produce a report based on what we find here, and suggest a course of action to both Mr. Sadena and the Ark. If Sadena decides he doesn't want to do any of the things we present to him, it's not like we can force him." She smiled thinly. "Any more than he can force us to lie about our findings."

"Is it Noah's Ark's position that a human arbitrarily granted with enough money to own a planet automatically has the right to destroy it, if they choose?"

Rahel snorted and tossed a look toward the sky. "Where do you get this crap?"

"I only ask what my readers would, if they were posing the questions."

Rahel nodded, unimpressed. "Then your readers are idiots."

"Her readers are here."

She and Keim twisted about together at Paval's growled remark. "What?"

Scowling off to his left, Paval threw the pack he'd been rummaging through to the floor of the boat. "There are laws against *them* congregating on private property, aren't there? Doesn't a privately owned planet count?"

Rahel rotated to follow the irritated wave of his arm, and glimpsed an uneven clot of green undulating with the waves where the sea met the sky. "Apparently not." She even flipped off her visor to make sure all the hoods and jackets really were in emerald, and not just distorted by the colored lenses. "Shit."

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The demonstration group was the usual motley collection of shouting and mismatched green. It was apparently traditional that members of a Green rally pull together whatever emerald, kelly, olive, or lime clothing they had lying around, swarming the point in question like leaves blown from a hundred different trees. They were the only officially organized group that managed to make the Ark's khaki brown bush suits look like a fascist uniform. Rahel supposed that impression was intentional, which only served to irritate her more.

"Did you tell them to show up here?" she asked, turning back to Keim. "Something to make the interview a little more lively?"

"Are you kidding?" Keim didn't seem able to take her eyes off the renegade flotilla as she folded her notebook and slipped it into a pocket of her blouse. "The kind of Greens who come all this way just to cause trouble are fruitcakes."

Rahel snorted, and Keim shot a frown at her as though anticipating what she was planning to say. "That doesn't invalidate what they stand for," she insisted before Rahel could even consider a remark. "It just means not everyone in the Green is a good judge of how to best accomplish those goals."

Considering that hard-core Greens didn't believe humans should be allowed to set foot anywhere except their native Earth—and perhaps not even there—it was a small wonder they didn't know how to react to the rest of their species' antagonism. "But they're here because of your uploads, yes?"

Keim pursed her lips and nodded, not taking her eyes from the rapidly growing green blot. "Probably."

"My God! Don't you even wait for facts before you—"

Rahel leaned across Keim to push Paval back into his seat before he could upset the skate's delicate balance. "Not now!" She dropped back into her own seat, facing Keim. "Any chance they'll listen if you tell them to back off?"

Keim looked at her as though surprised she'd even made the suggestion, then shrugged. "Most likely they'll think I'm only taking your side because we're in the same boat."

"And are you?" Rahel asked.

"Am I what?"

"Taking our side."

Keim made a face and turned back toward the Greens. "I haven't even said I'll talk to them yet."

The only difference between lawyers and reporters was their graduate degree. Rahel lifted her chin to call up toward the mechanical pilot, "I suppose it's too much to ask that they're nowhere near where we need to be."

The pilot extended a small remote mike in her direction from a panel low on its subjective back. "Query error." Its voice was finely tuned and masculine, but oddly devoid of character. Rahel wondered what it had been before it was Newborn. "Syntax not sufficient for specific data retrieval."

Paval twisted impatiently to face the bow of the skate. "Show us the coordinates of those other boats."

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A brightly colored topo map grew into being above the skate's dash. The overlaid location of the Green flotilla made an almost visible dent in the trench near the middle of the hologram.

Rahel grumbled. "Of course. Shit."

The pilot remained singularly unaffected by her profanity. "Instruction: Please present activity modifications in command or query mode."

Paval, equally frustrated, gripped the edge of his seat with both hands. "Can't we just go around them?" The pilot apparently took that as a course change, and eased the skate into a parabola.

"Go around to where?" Rahel's shadow swept across the floor of the boat as they swung into a wide arc around the hub of waiting Greens. "They're sitting right on top of the jelly breeding site—there's no 'around' to go to."

"But *why?*" Paval rotated as though unable to move in sync with the skate, his face directed toward the protestors no matter how wide a circle their own craft made. "Don't they understand we care about preserving this habitat as much as they do?"

A shout of recognition stuttered through the flock of Greens, and two boats—the only two fitted with outboard motors—awkwardly disengaged from the rest of the group to carve an interception course through the water. The mass of Greens was already close enough that Rahel could make out their individual faces. "Recognize any of them?" she asked Keim.

The reporter spared her only a single disgusted glance. "What? You think everybody in a conservation organization knows everybody else?"

"It was worth a try."

"No, I don't know them."

Rahel kept her eyes on the two approaching craft, trying to estimate whether or not they'd catch up to the skate before it finished its swing. "They're not inflatables," she commented aloud. "That means they've got their own aircraft, probably even their own jumpship in the system. God, I hope they didn't set down anywhere near here—the vibrations could kill those jellyfish."

Paval pulled off his skinsuit hood in one quick, angry motion. "What of them the outboards don't chew up!"

She'd never seen him angry before now, and, for some reason, the sudden appearance of his temper made her smile. "The outboards don't reach deep enough. This time of day, the jellies are a good ten meters under to get away from the light." Climbing forward to slap the pilot's carapace, Rahel hoped it followed her gesture as she pointed toward the approaching Greens.

"So what are we going to do?" Keim asked, stylus poised above the screen of her notebook. "Run or stay?"

Rahel opened her mouth, but didn't even manage an intake of breath before Paval was at her side, dark eyes locked on the approaching boats. "This kind of stupidity should be illegal!" he shouted, at them more than her, and apparently for their benefit. "Those hypocrites don't even understand what it is they're fighting

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for—!"

Rahel knotted one hand in her hair to keep from knocking her apprentice into the sea. "Will you just shut up?"

"Query error: Syntax—"

"Not you," Rahel cut the pilot off with another bang on its carapace. "This is a command: Pull away from the approaching boats, but not too far." She tried to ignore Paval's chain of foreign curses as she frowned across the bright water at the protestors. "I don't want them to think we're running away."

"Who cares what they think?" Rocking unsteadily as the skate purred into motion, Paval took two stumbling steps to his left to maintain eye contact with the closest raft full of Greens while their own boat edged forward. "They should be back at the resort, talking to all those reporters about why they think they're better able to save the stellar jellies than we are!" He shook Rahel's hand off his arm and shouted angrily across the water, "Ecologists are all supposed to be on the same side!"

That's when Rahel saw the spear gun.

Hooking her arm across his chest, she yanked Paval back with all her weight, tumbling them both to the floor of the narrow skate. Keim gave a short shriek, then a loud, hollow *thok!* echoed flatly through the space between the seats. Rahel felt a painful thrill of relief even before her rational brain realized the sound meant a spear striking boat sides, not a spear striking flesh. "Get down!" she shouted without looking behind. "They're not gonna wait to find out your credentials!"

Keim scrambled to the rear of the boat in a thumping clatter, and Rahel pushed herself up with one hand, shoving Paval back down to the deck with her other. She raised her head to look over the side just as the skate jerked and heeled over almost onto its side.

Then they righted again with a smack. Rahel gripped the wet rail with both hands, too stunned to see, but knew from the salty sting of wind on her face that they were moving—and not in a forward direction.

"What happened?" Paval's voice, so hoarse and quiet after his flash of anger, barely carried over the hum of the skate's laboring engine.

Water, chill from a long night of darkness, gushed past Rahel's leg and into Paval's lap. The spear had split a hole longer than the spread of Rahel's hand in the side of the skate, then filled most of it with the head and shaft of the weapon and a steady spatter of water. Her stomach clenched sickly at the image of one of them sitting with their back to that bulkhead. All the same, their skate probably wouldn't have been flooding so badly if the Greens hadn't attached the spear's tether to the two outboards so they could drag the skate behind them in their own choppy wake.

Suddenly remembering the pilot, Rahel scrambled on her knees to the front of their craft. "Pull us loose!"

"Command noted." Despite its stoical monotone, the Newborn was doing a wonderful impression of pan-

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icked human flight as it slewed the skate to make slack in the tow-line. "Data point: Designation of skate #6398240 is as a recreational vehicle, not as a high-performance water craft."

"Now he tells me." The cable snapped taut again with a thrum, and Rahel heard Paval thump into one of the seats with an angry curse.

Water sloshed wrist-high across the floor as Rahel crawled back toward the passenger seats. The space under her sitting place was empty, only a stretched fragment of fabric suggesting how her pack had gone overboard when the skate first tipped. She growled in frustration and grabbed at her seat for support. "Your phone!"

Keim, half-crammed under the farthest back seat, frowned at Rahel while she struggled to free herself.

"Find a goddammed phone!" If they couldn't get themselves out of this, they could at least call the Startide for reinforcements. The skate bucked, and Rahel slammed up hard against the opposite rail.

"Where are they taking us?" Keim shouted back at her. But she had one arm buried up to the elbow in Paval's field pack when she asked it, so Rahel didn't feel any immediate need to beat her for being distracted.

Not that she would have had the chance. Broken shadows flickered across the skate like tongues of cold, black flame, and the boat's own engine noise surrounded them in a cloud of bugs and bitter stench. A length of now-slack cable lashed a wake through the tree roots and swamp beneath the skate, then leapt with a crack of surprise when the skate sheered against some obstacle Rahel couldn't see, and overturned them all into the rancid mud.

"Data point: Mathematical models indicate that inversion of skate #6398240 is unlikely while antigravity repulsor units are still engaged."

Rahel gritted her teeth, shoving one shoulder against the side of the overturned skate and trying not to notice that the only movement she felt was her own feet sliding backward through the mud. A lurid belch of vapor curled up from the disturbed sediment, and she stumbled upright with a cough to escape the foul smell. "You could help me, you know!"

"Request noted." The pilot, its boxy body wedged above the water in a snarl of tree roots, was silent for nearly thirty seconds. "Data point: Reinforced appendages are prerequisite before external leverage adequate for independent motion can be achieved."

Rahel growled and dropped her head against the skate. Keim volunteered in a slow, helpful voice, "He doesn't have any legs."

It had been more a smart remark and less a real suggestion, anyway. "What about the antigravs?" Lifting up on her toes, Rahel stretched across the bow of the skate to rest her weary arms. Keim sat perched atop a knee of root to the pilot's left, lips pursed as she searched for dry patches on her clothing with which to clean her ruined notebook. Rahel couldn't help thinking how she would feel if it had

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been *her* data lost to the slough. "Any chance you can disengage the antigravs from there?" she asked the pilot.

"Request noted. Unable to comply. Data point: All ship's functions are referenced via hardwired terminal junctures."

Which, of course, ceased to be hardwired to the pilot right about the time the lower part of its casing tore away from the skate. She didn't even bother asking about the radio—it languished along with the antigrav controls under twenty-odd centimeters of mud, sinking deeper by the minute. Rahel kicked one of the boat's dented sides, but didn't even get a satisfying *boom!* for her effort.

The slosh and suck of shin-deep mud reached them just ahead of Paval's disgusted groan. It was a sentiment Rahel could well appreciate right now. Every step, every movement in the brackish water broke the delicate layer of surface tension protecting their noses from the cesspool underneath. Bugs and little biting things not even big enough to see swarmed each upsurge of stench, changing their focus to breath-letting orifices and sweat-sticky skin as soon as their filthy bug brains recognized that higher lifeforms were around. In general, Rahel tried to keep an open mind about the role various lifeforms played in their environments—but if she had to snort out one more noseful of midges or spit another spider-legged intruder into her palm, she was going to storm through this slough and personally squash every flying thing she found.

Paval lumbered into view one long, awkward step at a time. He nearly lost his balance twice when his rear foot refused to peel out of the mire and his leading foot sank deeper than he expected, but he freed himself without glancing up for help, brow furrowed, mouth clamped resolutely shut against the fuzzy cloud of buzzing around him. His effort to wipe the mud from his face had only turned him into a more severe copy of himself—dark eyes smoldered inside a negative raccoon mask of cleanness, and his hair was plastered sloppily to his skull in five uneven, finger-wide furrows. Mindful of what a mirror for her he probably made, Rahel scraped her own hands down both cheeks and flicked what mud she got back into the water.

"This was all I could find." Paval swung his arm up between them, dangling the soaked, twisted remnant of pack into Rahel's hands as he stumbled to a stop. Invisible midges and their more visible cousins jostled for position in his breath stream. "The rest must have gone under already."

The pack strap felt cold and slimy in her grip. Wrapping one arm under the bottom of the bag to steady it, Rahel dug her free hand inside to paw through the muddy contents. "No phone?"

Paval coughed, temporarily shattering the cloud of bugs, and sat heavily among the roots on the other side of the pilot. "No phone."

"Damn."

"Not that it would matter." He aimed a sour look at the ruined notebook in Keim's lap. "Our phones weren't designed for swamp duty any

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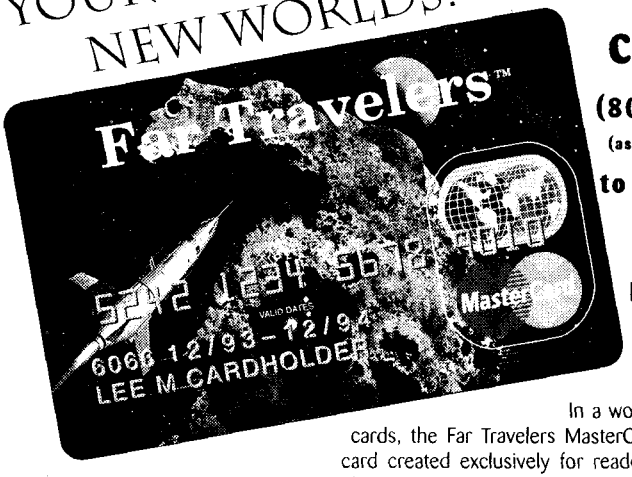

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more than her notebook was." Rahel watched him clap an uncounted number of bugs to death between his palms, and wondered if he was thinking about the Greens. "We're screwed."

"Any chance your groupies will follow us in here? Maybe try and do some more damage?"

Keim looked up from her labors, as though surprised that Rahel had asked her. "How should I know?"

"You write for them, don't you?" Rahel countered. "You must know something about the way they think."

"I know how the GreeNet editors think," Keim said. She finally gave up and refolded her notebook into her jacket pocket. "And they just happen to prefer a more radical shade of Green than I might personally wear."

Which answered at least one question.

Paval splashed one foot scornfully in the slime of mud below him. "Whatever color they are, their boats still need water. They could never make it back here through all this muck." Another million insects died with a sharp report. "And no one in his right mind would *walk* in this filth."

Grinning, Rahel yanked shut the zipper on their ruined equipment pack and turned to hang it on the bush behind her. "I guess that tells me where *we're* gonna stand."

Paval made a sound of weary sarcasm. "Oh, great."

"What?" Bugs and noxious gas swelled up as if from nowhere as Keim slid down from her perch with a splash. "We *walk?* You can't be serious!"

Rahel shrugged. "You got any better ideas?"

"Yes! We wait right where we are."

Rahel snorted with laughter, and Paval rocked forward to hang his head between his knees. "We wait for what?" Rahel asked the reporter. "The hotel thinks we're out here collecting samples, and Nils knows me well enough not to expect any chitchat until we're done. It's not going to occur to anyone to come looking for us until well after dark. Which is about. . . ." She made a show of squinting up at the sky through the ratty canopy of leaves. "Ten or eleven hours from now."

"We'll *all* be eaten to death before then." Paval swatted at some crawling thing on his hand, but not quickly enough to keep it from biting him.

"Well, then—" Rahel leaned over and pulled him groaning to his feet. "A little healthy exertion won't make things any worse, now, will it?"

"System request."

At first, the toneless voice surprised her. Then she looked over Paval's shoulder and remembered the disabled pilot, still propped among the tree roots and too heavy to carry.

"Data point: This unit massed 523.6 kilograms before truncation," it said, as if reading her thoughts in her expression. Maybe it could. "Data point: Central memory package masses less than .5 kilograms. Data point: All but memory is hardware. Request: Transport memory package back to Startide homebase for installation in rebuilt chassis."

"Sure thing." She nodded Paval to-

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ward the Newborn, then turned to look a question at Keim. "How about you? You coming or staying?"

"Do I have any choice?" The reporter sighed as she watched Paval pry loose an access panel and pull the Newborn's memory free. "If only the trip could be so easy for all of us."

Rahel wondered how easy the pilot thought trusting its brain to three strangers must be. "What are you complaining about?" She clapped an arm across Keim's sagging shoulders and turned her in a generally westward direction. "You and the Greens say you want to rescue this planet. Well, it's time you got up close and personal with what it is you want to save."

Seven hours, sixteen minutes, and one lost skinsuit shoe later, they mounted the steps of the Startide Hotel.

Rahel lifted her head to squint up the long stone stairs ahead of them, but could only summon enough energy to sigh. Beside her, Paval placed his foot on the first step and said wearily, "This is going to hurt."

As if she had a pain threshold left to worry about.

Bugs, stench, and cool suck-mud had leached out every micron of vitality she had in the last seven hours. Now, the very business of lifting her feet from one step to the next took more concentration than she usually expended on cell titers, and sandy, mud-freckled footprints followed them up the stairs as they climbed. Rahel's eyes hurt from the endless glare off the Odarkan's surface, her throat hurt from coughing against the stink of rotten vegetation, and her legs hurt more than she could have imagined from high-stepping through the root-tangled mud. She'd been privately thrilled to have Keim struggling along with them—the reporter had given Rahel the excuse of occasionally calling a halt to let Keim catch up and get her breath. Rahel had done this at first because she really didn't want Keim expiring of heat stroke a million kilometers from nowhere. After a while, though, she stopped whenever her aching thighs couldn't stand pulling up against another step, and only said she was worried about the reporter. Neither of the others questioned her, but she had a feeling she wasn't fooling anyone.

The last hour of so of their trek, at least, had been free of the slough. They'd made better time across the narrow strand of beach, but the unbroken sun and scorching sand did its own brand of damage. Paval's face looked swollen and shiny where the sun had singed his skin, and Rahel's shoeless foot didn't feel a whole lot better. Keim, damn her, was miraculously unburned. It seemed somehow unfair that the reporter would be the only one to come out of this adventure unscathed, especially since it was more than just slightly her fault that they'd ended up stranded in the first place.

Wind, roaring faintly with the echoes of surf against sand, rolled over them without actually stirring a breeze. Struck suddenly with that incongruity, Rahel stopped and looked

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upward for the source of the blurry sound. She recognized it for distant cheering right about the time her brain identified the swarm of reporters and spybees pouring down the long staircase to meet them. She was surprised that she couldn't feel anything but dull annoyance at the prospect of confronting them, even with such a clear view of the jeering Greens discoloring the steps above them.

Her apprentice, however, hadn't yet reached such an impasse. Spitting some oath in a language Rahel couldn't identify, Paval scrambled toward the crowd of Greens at what would probably have been a run on any other day. Rahel watched him pound his way upward, his hands grabbing the steps ahead of him as if resorting to all-fours could hurry him, and found herself faintly envious of his youthful vigor. Even if he was expending it on a stupid display of male ego. Reporters scattered to let him through without so much as interrupting their shouted question.

"You probably oughta stop him," Keim commented drily when she finally trudged up alongside Rahel. The reporter sat with a weary groan, obviously not planning to go any farther.

Up top, Paval dove into the knot of Greens amidst a crescendo of media enthusiasm, disappearing beneath the resultant tumble. A burst of irate shouting marked his arrival.

"Yeah," Rahel sighed, glancing back at Keim. "Probably." Then she started upward at the same pace as before, keeping tabs on the fight by the number and color of epithets raining down around her as she climbed.

Not surprisingly, hotel security beat her to the brawl. By the time Rahel reached the long plaza, a fashionably tailored contingent of turquoise-and-salmon suits had pushed themselves through the confusion of Greens and buzzing cameras, surrounding the lone spot of Noah's Ark yellow and pushing him grudgingly toward the entrance of the Startide while the Greens formed a protective clot around one of their own. Even without the shouting and turmoil, the conflict of colors—not to mention philosophies—was enough to make her head hurt.

"Rahel?"

Just the pleasure of walking on hard, level ground nearly buckled her knees. She pretended not to notice Nils squirming toward her through the press of bodies, and tried to keep her ears, if not her eyes, locked on her apprentice.

"Proctor Tovin! Do you have anything to say about your findings so far?"

"Rahel, what is going on?" Nils appeared at her elbow, grabbing for her arm and looking her wildly up and down as though searching for some sign of damage. "My *God!*" He recoiled with a grimace when his hand made contact with her suit, then had to trot a few steps to catch up with her again. "You smell like a sewer! What happened?"

"Anoxic organic decomposition. I'll explain it to you someday."

"Proctor Tovin, is it true that you've requested Noah's Ark to re-

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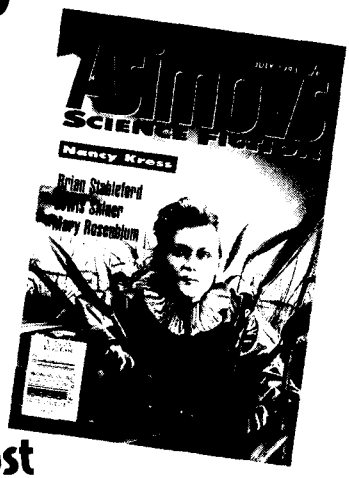

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move you from this safari?"

Ignoring the reporters, Rahel reached past the shoulders of two of the security guards to seize her apprentice's collar. "I've got him."

"Wait a minute, lady—"

"I said I've got him!" Elbowing the guard aside, she dragged Paval to her with a single imperative tug. The young man stumbled, pulled off balance by her hold on his collar, but didn't try to break her grip. Rahel couldn't tell if the scarlet in his cheeks was emotion or sunburn.

"Can you tell us if charges can be brought against Mr. Sadena?"

You can't sue somebody for pissing in his own bed, she thought but didn't say, then pushed past that reporter just like she had already had all the others. "Hell of a job you're doing here, Nils." She spared the other proctor a sour scowl as she worked her way out of the knot of security guards. "Have you gotten past the wine and hors d'oeuvres stage yet?"

Nils blinked at her. "What?" He looked too sincere to even be worth yelling at.

"I wouldn't belittle Proctor Oberjen's work if I were you, Proctor Tovin." Valhanryn Esz, the stringer from *Tomorrow Today,* snapped fingers to redirect her minicam and narrowed almond eyes at Rahel. "It's only because of his cooperation that the media hasn't characterized your behavior as a deliberate obstruction of free speech."

Paval stiffened next to her, and Rahel didn't even wait to see what brilliant rejoinder he might produce. Clapping her hand over his mouth, she matched stares with Esz over Nils's shoulder. "Obstruction?" If she had the strength for humor, she might even find the idea laughable. "Guess what, boys and girls?" she called, loudly enough that Nils winced and reporters half a staircase down pricked their ears. "Noah's Ark isn't on Uriel just to supply fodder for your netlink uploads. We've actually got a job to do—a very serious job." She scowled at the Greens cordoned behind hotel security. "These assholes aren't helping." When Paval reached up to grip her wrist in both hands, she tightened her fingers on his jaw as a silent warning not to piss her off any further. He let his hands drop back to his sides.

"The Greens?" Nils twisted a look over his shoulder at the activists, frowned at the reporters, then turned a hopeless shrug on Rahel. "What have they got to do with this?" he asked blankly. "Where did they come from?"

"Out of her uploads to GreeNet." Rahel jerked a nod down at Keim, still watching from the foot of the long staircase. "Whatever 'free speech' she's been dumping on them, it just convinced *them* to dump us in the slough along with Sadena's million credit skate and a busted-up Newborn."

"Oh, my God. . . ."

She almost enjoyed the look of pale horror on the other proctor's face as she dropped the half-kilo memory pack into his hand. "Tell Sadena he can avoid future equipment loss by using some of his influence to keep Greens and reporters out of our hair

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instead of kissing up to them. And we're going to need some pretty basic sampling equipment replaced, not to mention a little extra time built into the project."

"Does that mean you're not prepared to make a statement about the cause of Uriel's ecological crisis?"

Scraping her hand up the front of Paval's skinsuit, Rahel collected a handful of stinking mud and slapped it onto the reporter's notebook. "That's right—I'm not."

"Rahel!"

Cameras and notepads flew into excited activity even as Nils hurried to interpose himself between the reporters and his colleagues. Crooking her arm around Paval's neck, Rahel turned her back on the crowd and limped toward the hotel entrance with Paval firmly at her side, leaving Nils to sputter whatever apologies or explanations struck his fancy.

The next day, two plastically handsome young men in turquoise-and-salmon suits met Rahel at the door of her suite to escort her up to the roof of the Startide. They tried hard to make the detour chatty and inoffensive. Their smooth and well-practiced behavior, however, only convinced Rahel even more that Sadena was beginning to consider the Greens a greater risk than the feeding frenzy of reporters. By the time they joined Paval and his own escort beneath the wings of an elegantly sculpted short-range hop, Rahel could hear the Green chant of "You stay, you pay!" battling against a babble of reporter questions below. Nils, poor thing, was probably down there already, wading through the morass of human stupidity and earning his keep.

"I don't know what's worse," Rahel commented aloud as she mounted the stairs into the open hatch. "A day penned up with those reporters, or another hike through the margin sloughs."

Paval followed with a new equipment pack slung across one shoulder. "At least the reporters don't stink or bite."

He obviously hadn't dealt with the press for very long.

In contrast to their two previous sojourns into the Odarkan, the hop lifted them away from the Startide's landing field in whisper silence, with no real sense of acceleration to betray the moment when they took off. There weren't even windows or viewscreens in the passenger cabin. No scenery to watch, no reporters to piss at, no fresh air to breathe. Rahel sat heavily on the silk brocade settee and watched Paval experiment with opening and closing the bar with one flipper.

"This place is nicer than our hotel rooms," he said at last. Apparently, the tri-D VR cabaret impressed him.

Rahel was more worried about the immediate reality before them. "You ever done an ocean dive before?" It was something they should have talked about yesterday, but Keim's presence had sidetracked things somewhat.

Paval glanced at her over his shoulder, then shrugged and went back to playing with the entertainment automation. "Recreational scuba, but not

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with these kinds of skinsuits. I've done a lot of EV work, though. I figure these suits can't be very different."

Not that Rahel would know. She tended to avoid EV at least as much as she avoided underwater time. "No rebreathers," she told him, snapping her own flippers onto her feet. "The skinsuit extracts dissolved gases from the surrounding water to supply you with breathable atmosphere, then uses the waste gases to keep you warm, keep you buoyant, and whatever else you need to stay happy underwater." She'd passed Ark certification in these skinsuits only a few months before, so still had a lot of the junk information memorized. That had been in an aqua tank back home, though, with less than four meters of water over her head. "Skinsuits won't process as fast as a tank system, so you can't get too wildly active. These things were designed so we could bob around watching animals without coming up for air, not so we could tango underwater."

Paval nodded, then turned away from Sadena's techno gadgets as though just realizing that Rahel was ready to get down to business. "That's why sport divers don't use them," he said as he sat on an ottoman directly in front of her. "But I watched somebody in a full skinsuit once, and I've always wanted to try one."

"Well, now's your chance." Rahel leaned forward to grab the ottoman's skirt, dragging it and her apprentice to within touching range. "The buoyancy control device is built in, just like usual. You vent it—" She pulled Paval's mask down over his face and tapped the upper left-hand corner, "—here. Blink twice to vent, three times to fill. One long blink stops it, either way."

Paval raised both hands to touch the sides of his mask, then had to reach quickly to his right when the hop banked abruptly and started its descent. "Two, three, one. Got it." The full-face visor kept Rahel from seeing his expression, but he sounded grim enough to sink a boat. A young man's way of paying attention.

"Your BCD pressure valve is still back here." She slapped the vent at the back of his neck, and he nodded understanding while gathering up the bandolier with his slides and sample bottles. "Be careful—the blink toggle is a lot touchier than the tongue release. You'll lose buoyancy faster than you expect. Play around with it while you're still up top, and don't dive 'til you're sure you've got the feel."

And that was all they had time for. A resort employee in a fashionable short-sleeved halter cat-footed out to them from the cockpit and hurried them politely toward a cargo door in the farthest back compartment. From there, a wide open loading platform lowered them through the floor and into the bright, heady spangle of full sunlight above the rucked-up sea. The skate waiting below looked nearly shattered by the force of the hop's repulsors.

"I think I liked the balloons better," Rahel commented as the skate pilot ran out to meet them. Paval only grunted. She assumed that meant he was no more crazy about trying to

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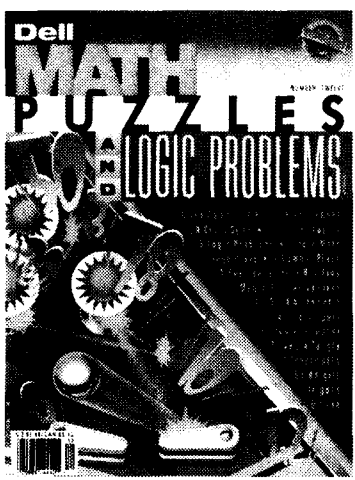

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jump from one craft to the other than she was.

"Slide down on your bottom!" the pilot shouted above the hop's wind pollution. Rahel recognized his iron-dark features and patterned shirt from their first night counting jellies from the air. "I'll take your gear, ma'am! You just slide on down!"

Gripping a corner cable with one hand, she eased herself awkwardly over the edge of the platform and dangled her pack into Jynn's waiting arms. He placed it quickly but gently to one side, then positioned himself underneath her to offer support while she slid down after it.

"Is this thing gonna be here the whole time we're under?" she asked as Jynn guided Paval down in turn. She didn't like trying to imagine the noise and turbulence the aircraft's constant presence might cause.

"Oh, no, ma'am." The pilot darted a smile at her before turning back to wave off the waiting hop. "We'll be going another few kilometers north and east of here yet. Mr. Sadena arranged it specially so we wouldn't put you down right on top the jellyfish site."

Instinct made Rahel grab the edge of the skate when the hop's retreating pressure swell shoved it down into the water, then roughly released it again. "Apparently, fuel and time are not an issue as far as Mr. Sadena is concerned." She scowled at Paval when he stumbled against her, but didn't shake him off when he ended up clinging to her shoulder to steady himself.

"Mr. Sadena's not the sort of man who cares too much what it costs to get his druthers," Jynn remarked as he picked his way across the heaving deck toward the pilot's station. He flashed Rahel a wry smile as he squeezed himself past. "But, then, I figure you noticed that already."

Samples, Cells, and Stiffs. That was the litany Rahel had created to remind Paval, and herself, of their goals for this dive. As a mnemonic, it wasn't the most brilliant creation, but it seemed to serve its purpose. When she asked Paval what he was going down for while Jynn piloted them the last hundred meters to their dive site, her apprentice held up his hand and ticked off three fingers without even pausing to think.

"Water samples to screen for contaminants. Cell samples from both breeding polyps and new medusae, but no eggs, no live larvae, and no live medusae. Any dead jellies—larvae or medusae—I might find floating around." He grinned at her then, in that irritatingly youthful way that made him look ten years younger than he probably was. "At least I'll be able to fit my corpses into a specimen jar."

Rahel pulled her mask down to cover her unamused scowl. "That falls into the category of 'something I'll deal with when I get to it.'"

Dropping their speed, Jynn mated the boat so gently with the water that their sudden entrance into the rhythms of the Odarkan seemed almost magical to Rahel. She hadn't realized how much she missed the heavy swaying of a boat on the breast

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of the water, how separated Sadena's code of zero impact required each person to be from the living world surrounding them.

On the wake of that thought, a fierce specter of dilemma swelled inside her. Could humans learn to love a world they weren't allowed to touch? Could humans touch a world and not disrupt the thing they claimed to cherish? Rahel had a feeling the answer sat somewhere between the Greens' radical separatism, Noah's Ark's respectful intervention, and Feles Sadena's sanitized exploitation. Yet still outside the reach of the everyday human. It wasn't a happy thought just before this kind of sampling dive.

"OK, Junior, let's go."

Leaving Paval to settle his mask and pick up his gear, Rahel slipped over the side into water warmer than she'd expected. A pleased but startled shiver rippled just beneath the surface of her diving suit. The sea closed its gentle grip around her as if to soothe her fears, and suddenly her horizon became a disc of glass from elbow-to-elbow, a steady platter with her in the middle and the sky all around bobbing and dipping in every direction. She blinked on the BCD control in the upper corner of her mask, and melted below the surface on the drag of her equipment belt and body weights.

As usual, Rahel's first underwater breath took a touch of bravery and a lot of faith. It was one thing to know that diving gear would keep you safe in an ocean environment, another thing to truly believe it. Her first breath hitched up short, and she had to forcefully clear her lungs and make herself breathe more deeply the second time around. It only partly worked. She felt the dissatisfied tightness in her lungs that said she still hadn't filled them completely, and had to adjust her perceptions yet again to breathe what felt like a huge, languid sigh against her mask. This time her body relaxed a little with the flush of oxygenated air. Rahel tried to set a flag in her brain to remind her that even breathing couldn't be taken for granted down here in the stellar jellies' realm. Even that much thought threw her off rhythm, though, and forced her to pattern her breathing again.

Sunlight glanced brightly off the surface far above her. It bleached the sky gray-white, and blurred all sign of Jynn's skate except for a dark, broken outline where the resting craft met the water. Below, beetle-green stretched as deep as the brightness would allow, then a silent, shifting mat of shadow formed a floor on which the sunlight pooled. The first ripple of light across that surface brought a smile to Rahel's face: movement. She blinked again on her BCD, and let its functions draw her slowly downward.

"This is incredible!"

The sound of Paval's voice in her left ear made her glance unconsciously over that shoulder. A shimmer of reflective flatworms exploded silently away from her sudden movement. Rahel relaxed to face her own subjective forward again, reminding herself with a sting of annoyance that

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hearing her apprentice through a suit comm told her nothing about where he was in relation to her.

"Be careful." That seemed a safe admonition, regardless of what he was doing. A jelly—half-unseen amongst the rest of the translucent mass below her—brushed languidly against her flipper, then furled away into the jumble of others. She pulled her knees up to give it more room.

"Don't worry—you're clear." Paval could apparently see her, though. He laughed as the jellies tumbled in a slow motion tangle, swelling and shrinking on dreamy puffs of motion. "Besides, their nematocysts can't penetrate most human skin. With these suits on, there's almost no chance they'll sting either of us."

"It's not us I'm worried about." Rahel sculled in a circle until she found her apprentice hovering far ahead on her right, his hands barely stirring the water above pearlescent bells wider across than he stood tall. The jellies rippled like a second surface in response to his soft movements. "I don't want you tearing any tentacles or floats on your way down. Push through them *gently*."

Paval nodded, his expression unreadable through his mask at such a distance. "I'll be careful." He sounded a tiny bit chastened, though. "I'll be another twenty straight down. Call me if you need me." And he melted into the mat of jellies before she could comment further on his handling.

Samples, Cells, and Stiffs, she reminded herself. There was still a lot of work to do. Tucking her knees against her chest, she wrapped her arms around the backs of her thighs and blinked the BCD to take her lower.

Jellyfish membrane oozed across her feet, her back, her shoulders. They were warm, like the water, and nearly as fluid, flowing away from her slow passage the way bubbles slipped around a falling stone. Flashes of silent, cold-bright lightning formed their only response to Rahel's brushes with their bodies. In their gentle liquid world, this must have been the same as startled cries. She felt obscurely guilty for disturbing them. Even acknowledging that they hadn't enough nervous system to truly notice or care didn't make her feel any better.

The kiss of their fragile bodies lifted, drifted upward, and Rahel was suddenly beneath them. Tentacles floated around her in tangles and clouds. A long, lace-like ruffle marked the center of each delicate creature, and ghostly colors flickered up the crinkled edges almost in time with her breathing. The net of sparks that laced their bells whenever they jostled against each other made it easy to understand why tourists paid so much to watch them rise and feed every night. Absently watching little swarms of aquatic insects dart from ruffle to ruffle, Rahel wondered how many tourists had ever tried to imagine the subtlety of organisms with skin but one cell thick, much less what that said about the complexity of the rest of their world. All she could picture was Feles Sadena offering gratis dinners to anyone who found the concept of Darwinian hier-

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archy too stressful for patrician comfort.

Sunlight filtered past the gossamer flotilla, mottled abstract patterns across the yellow-and-black panels of Rahel's skinsuit. Jellyfish thoughts reflected. There couldn't have been more than thirty of the creatures, drifting with their aimless jellyfish whims, yet they made a raft nearly forty meters at its widest. Uncounted ruffles and threads of tissue sifted through the darkness below them. Tipping herself horizontal, Rahel flashed the beam of her handlamp through the water below as she worked a string of water sample bottles off her equipment belt.

"I'm not seeing much in the way of juveniles," she commented aloud. "The smallest one I've got up here—" She rolled a look over each shoulder, "—is still about two and a half meters across. That's almost big enough to head for open water within the next few weeks." She was guessing a little on that timeframe—she knew it took a good three Uriel months for stellar jellies to reach migrating size, but didn't have the slightest idea about their growth curve. "Maybe something's inhibiting breeding before they head out."

"Then they should be dropping larvae in the main ocean, with a corresponding rise in the stellar jelly population out there."

And so far no one on Uriel had reported finding another stellar jellyfish breeding population. Rahel shrugged, capping her water samples and threading them back onto her belt. "We can check the water here for larvae and ephyrae, and I'll do a head count on the ovigerous adults to see how many are carrying egg clusters."

Paval's breath snorted against his pick-up wherever he floated far beneath her. "I can't speak for this year's crop, but they seem to have done all right the last few years. We've got what looks like a good carpet of polyps, and—" He cut himself off with some noncommittal curious noise. "Oh, now *that's* weird."

"What?" Rahel made an impatient face in his general direction. "Talk up, Junior, or I'm leaving you here."

He took a breath, as though planning to say something else, and instead only coughed once, shortly.

For an instant, Rahel thought Paval meant this sound as his reply. Some private ritual of disgust—at the jellyfish for doing something unexpected, or himself for fumbling his sampling gear, or even Rahel for the tireless lash of sarcasm that had finally found the end of his patience. But the next bark of sound across her skinsuit's comm was unmistakably choked with panic, and the pain behind his strangling was impossible to ignore.

"Paval?" She tried to keep her voice calm, flailing herself into an awkward spin in search of she didn't know what, trying to remember exactly where he went down. "Paval, where are you?"

The ocean's heavy presence crowded her senses with blobs of blurred data. Sounds as thick and clumsy as slough mud stuffed her ears while sights made up of nothing but bubbles sheeted everything else from view. A smoky tangle of jellyfish ten-

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drils curled and flattened against her face. "Dammit, apprentice, answer me!"

His sobs over the comm channel were no help. No matter where she twisted, his voice hung eternally over her left shoulder, distorting her perspective when his coughing broke down into whistling gasps. Rahel dumped her BCD with two frantic blinks, then kicked downward as hard as she was able.

"Ma'am, what's the matter?" A new voice sliced across the channel, quick and high with alarm. "Can I do something?" Jynn asked frantically. "Can I help? What happened?"

Like a smear of smoke against cracked glass, a wash of body and bubbles rocketed surfaceward an unreachable distance ahead of her.

"Careful!" Rahel tried to bring her flippers down under her, pushing against the water until she could slew to a stop and struggle her way in his direction. "Paval, don't surface too fast!" It didn't matter—he disappeared into the glistening curtain of jellies that blotched out the sun. "Jynn, we're coming up! Don't let him hurt himself!"

Thirty meters in less than thirty seconds. God. Rahel kick-started her own ascent, resisting the urge to race her bubbles to the surface, worrying that Paval had made things even worse by giving himself decompression illness in his panic. *How could things be worse?* She didn't even know what had happened yet. Maybe he hadn't been down long enough. The deepest of the jellyfish tendrils wafted against her faceplate, then twitched dreamily away again in rhythm to pulsing bells far above. Rahel stretched her arms over her head to reeve a gentle passage through the gossamer forest.

She broke surface with more momentum than she thought she carried. Air crashed around her in place of water, and the kick and bob of wind-driven waves replaced the stillness of only a few meters below. Rahel caught herself, arms spread wide across the water, when she would have splashed back under again, fighting to equalize her BCD to keep her buoyant. The skate floated less than a dozen meters away. Only the back of Jynn's lavender crew shirt showed where the pilot knelt on the bottom of the boat, bending over something that Rahel couldn't see. She kicked off as powerfully as she could, at the same time chinning her comm and shouting, "I'm coming! Tell him I'm coming!" She didn't even know if Jynn was still monitoring the line.

Jynn met her at the side of the skate, though, and grabbed her at belt and shoulder to haul her over the side. She splashed to the deck in a slosh of excess water. "What happened?" the pilot asked, pulling her into a sitting position. "Ma'am, what happened to him?"

"I don't know!" Rahel struggled to her knees almost on top of Paval. He was clenched into a fetal curl, a froth of vomit pooled along the curve of his face mask as he jerked dully, weakly. She grabbed Jynn with one hand and pushed him toward the front of the skate. "Get us to shore!"

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Her fingers felt numb and stupid as she fumbled to unlatch her apprentice's visor.

Water splashed across her knees, against the curve of Paval's back when Jynn jump-started the antigravs without first priming the engines. Rahel slipped one hand under the boy's cheek to lift his mouth clear of the rolling lake in the bottom of the boat, then snapped aside his faceplate to dump the accumulated vomit.

And recoiled from the puff of bitter stench that escaped his mask beneath her fingers.

"Oh, no. . . ."

Rahel couldn't hear Paval's gasping above the rush of wind and sea, but she could see the frantic working of his jaw as he sucked down every breath, could feel the rigid quiver of every fighting muscle. His eyes, pupils dilated to unseeing black coins, glistened pinkly, and a thin stream of mucous ran from his nose. When she bent to sniff his open lips, the biting stink of rotten egg stung tears into her eyes.

"Jynn!"

She found the control of her oxygen mix in one of the skinsuit's submenus while she pushed Paval onto his back and threw his mask apparatus aside. Her brain remembered from somewhere that a medic would have given Paval oxygen right now, and his own suit was certainly no longer a trustworthy source of that gas. Unfortunately, she could only push her O_2 mix as high as 36 percent. She didn't know if 15 percent higher than normal would be enough to matter.

"Get that hop back here!" she shouted at the pilot as she dragged her mask down below her chin and flipped it to give the air to Paval. If only there was enough water in the boat to supply oxygen for more than a few seconds. "We've got to get him to shore *now!*"

Jynn only half-turned away from his controls. The spray thrown up by their velocity had seeded bright droplets through his tightly curled black hair. "Ma'am, we can't use the flyer!"

"The hell we can't!" She couldn't even mate much of her suit to the standing water—not and still keep good contact with her mask. She stretched out both legs and went down awkwardly on one elbow. "Dammit, we don't have time to argue!"

"No, ma'am." Jynn shook his head insistently. "I mean we *can't* use it. He can't go up, not so soon after being under. The bends could kill him!"

If the Greens hadn't killed him already. Rahel reached blindly for the pack under the seat ahead of them and tried not to let the skate's maneuvering shift too much of her weight across Paval's torso while she rummaged.

The phone fell out into the water with a plop. She snatched it out of the brine before it even hit the bottom and shook it open. Beneath her, Paval shuddered weakly.

The line opened after only half a ring.

"Rahel. . . ." Nils's sigh blended neatly with the surrounding roar. "I don't know how you can expect

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me—"

"Nils, shut up! We've got an emergency."

He cut himself off, and the skate passed between the straits and into a wall of shadow, slicing Rahel through with chill. "Paval?" Nils asked in a more contrite tone. He could at least put two-and-two together.

"Hydrogen sulfide." Rahel thought she still felt the rotten sting at the back of her nose, but knew that must be her *imagination*. "I don't know how bad it is—he's still breathing." *Barely*. She shifted position on top of him and forced that thought aside. "I promise you the hotel medic can't take care of this."

Nils's voice seemed to rise in pitch even as it blurred beyond understanding. He must have lowered the phone away from his mouth, cradling it against his shoulder, or his lap, or his chest while he shouted to someone farther away. The skate etched a neat pivot just beyond the mouth of the strait, ejecting them from shadow into blinding sun, and bucking Rahel off Paval into the swamped skate bottom. She twisted to keep the mask still on him and still connected to her own suit. Water made suits and deck slippery, and the primitive sense of shoreline flashing by on their left made Rahel's head ache. Picking the phone up out of the water was barely an afterthought.

"All right. . . ." Nils, of course, had no idea they'd been interrupted. "I've talked to Huan. He says he can 'link the continent directly and have someone fly out for pickup. It shouldn't take more than twenty minutes."

From time of contact or time of launch? The answer wouldn't change things, so Rahel didn't ask.

"What happened, Rahel? *Hydrogen sulfide?* How on Earth did he get exposed to that?"

Spatters of green broke up the hurried movement of hotel turquoise down to the Startide docks. Rahel watched both Greens and reporters gather morbidly at the back of the waiting medic team, and hatred and rage burned a hole straight through her. "How do you think?"

She didn't really care to hear Nils's answer.

Jynn killed their velocity with a stomach-dropping growl; the skate thudded the dock so loudly a dim echo lapped back at them from off the hotel's face. Hands grabbed her, grabbed Paval, rocked the skate and shivered the planking as they helped Rahel to the dock as much as they hindered her. When she stumbled beneath the pressure of tangled bodies, a strange, cool openness whispered across her front, and Rahel realized that Paval's body had slipped away from hers. A shock of panic jerked her to her knees. "Wait! My mask—!"

Was connected to her skinsuit, which was no longer in the water it needed to extract oxygen. She let her mask dangle underneath her chin, both hands still gripping the wet edges. The medics swung Paval onto their litter without pausing to acknowledge her cry.

Security closed in behind them like cells reknitting a wound. Only then did Rahel remember Paval's bando-

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lier of sample flasks, and the potentially lifesaving water trapped inside them. She jumped to her feet and glimpsed a flash of pale, glistening skin, heard the ghost of a sobbing gasp, before litter, team, and apprentice all melted beyond her sight. It didn't matter—Paval's skinsuited chest was empty, his bandolier lost somewhere between the jellyfish breeding grounds and home. Rahel hadn't even noticed it was missing before now. The dock beneath her feet seemed very hard, the sun beating down on her shoulders bright and cruelly hot.

How was she going to tell Saiah?

"Proctor Tovin, I'm sorry but. . . ."

She turned a look behind her, almost expecting to find Huan the Robotic Bellboy hovering behind her. Certainly no human being would dare approach her now with such an empty, idiotic palliative.

The dark-haired reporter behind her swept a minicam in front of her face and asked placidly, "Is this the first apprentice you've had die while you were on safari?"

Rahel hit him.

First with her elbow as she finished her turn, then with her fist, and her knee, and anything else she could reach him with as he scrambled back away from her with the minicam constantly circling them and his arms laced over his head.

But it was the green-clad arm that reached out to block her from the reporter that focused her anger with the strength of a well-aimed laser. "You bastard." The cold lucidity of her own voice made her even angrier, so she grabbed the interfering Green by the front of his emerald jerkin and shoved him to the ground. "You son of a bitch! How could you *do* something like this? How could *any* of you?"

"Rahel!" Nils, suddenly beside her, fumbled for a hold on her arm. He wasn't serious enough, though, and she pushed him away without even turning.

"What did he ever do to you? Did he ask Sadena to set up shop here? Did he decide by himself to make the stellar jellies die?" She kicked the downed Green once, maybe twice, then arms more determined in their grabbing snaked around her and dragged her backwards down the dock. Her feet skipped between puddles and dry spots as she scrabbled for footing on the Earth-imported boards. "He was just a kid, goddamn you! Just a stupid kid!"

"Proctor Tovin, *stop* it!" Keim forced her way between two of the hotel security, taking hold of Rahel's diving belt while she shoved the rest of the restrainers away. As if her grip and earnest scowl could hold Rahel more securely than physical prowess.

Rahel knocked Keim's hand aside and stepped back before she could grab her again. "Keep out of this, hypocrite. You and your netlink headlines have done enough harm already."

Keim pulled her chin up in surprise, and hurt glinted briefly in her eyes. In a way, it both relieved and disgusted Rahel to know she could still inflict damage with just the sound of her voice. It seemed the only

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power left her right now, and even that was pathetic and small. It couldn't have stopped anything that happened today.

Rahel stooped to fling first one, then the other flipper in no particular direction, and jumped off the dock's shore-side into sand barely deep enough to take her landing. The pain that jolted up her back as a result seemed appropriate somehow. On her left, a breeze that couldn't cut the heavy warmth of the sun feathered in from over the ocean, and timid waves licked the farthest fringes of shore, afraid to slide even as high as her shoes.

A dead jellyfish rode in and out on the tideless waves, and, somehow, that seemed appropriate, too.

No one came looking for her, and for that she was obscurely glad. She slipped into the ocean between glossy, muddy boulders that had rolled into the water years before from a cliff face high above, and let the slow, silent lives of plankton and pelagia float her anger away. Some numbed, removed part of her realized that it took an uncounted number of hours; a haline spider had furred nearly half her left shoe with uprooted hydroids before the angle of sunlight squeezed down too low to stimulate the little insect, then abandoned her to curl into its rock igloo and wait for morning. Loathe to destroy an entire day of spider work, Rahel eased her foot out of the flexible slipper and left the shoe behind.

The evening air felt deceptively chill on her face, the rough sand inappropriately warm between her bare toes. Moisture-rich clouds smeared the sun the color of ferrous clay. Even greenhouse planets breathed and cooled during the long, dark nights, Rahel told herself. And even Noah's Ark proctors could succumb to hypothermia. Peeling off the skinsuit mask with a sigh, she wiped salt water from her cheeks and turned to look back toward the indiscernible hotel. *Out of sight, out of mind.* If only that were true. The Startide and what she'd left there were all she'd been able to think about since retreating into the ocean. It had more to do with her returning than any true thoughts for her own safety.

That first step southward was so hard, she almost couldn't take the second.

But inertia was a wonderful thing. Once her body was in motion, it was willing to stay in motion, and walking soon became no harder than floating at the bottom of the inlet had been. As long as she didn't think too much about her destination. Not for the first time, she wished for the growl and sigh of sea waves for distraction.

"Oh, thank God."

The Startide had only just begun to take shape among the limestone and granite of the coastal cliff face, with the stairs to the primary dock still another kilometer or more down the beach. Rahel stopped, wondering how likely a reporter would be missed so far from the main hotel, and whether there was any chance some maintenance robot would find the body before she left the planet.

"I am *so* glad you can't hold your

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water as long as you can hold a grudge. Otherwise you might never have come home." Nils shifted his seat on one of the drier rocks at the foot of the bluff, pulling his light daytime jacket tighter closed beneath his chin. "Are you all right?"

Just because he was a lawyer didn't mean he couldn't ask stupid questions. "What do you think?" Rahel moved slowly up the beach to stand in front of him, not wanting any unwelcome listeners to pick up on their voices. "How long have you been out here?"

Nils twitched a shoulder in a half-shrug, half-shiver, glancing around at the now-dark scenery as though surveying a gathering of old friends. "Oh, not that long," he sighed with dramatic nonchalance. "Five, maybe six hours." He looked up at her and smiled. Even his friendly smiles always managed to look priggish and thin. "Huan showed me a service tunnel just up the hill from here. It beats the hell out of going through the reporters, and I thought you might enjoy the detour."

Because the nets want to ask me some horrible questions, and I don't want to give the answers; I don't want to have to know the answers. She didn't even want to have to ask Nils, and he'd been sitting out here half the day waiting to tell her. She made herself look him straight in the face, but then could only squeeze her hands into fists when she knew she ought to be speaking.

Nils saved her with a nod. "Paval's alive," he said, very serious now despite his gentle tone. "The medical team got here just a little while after you left—" A slight smile broke through and he cocked his head in dry comment. "A record, Huan says. They brought a mobile ER unit with them, and took Paval into their ship for treatment the minute they got here. It was good you gave him oxygen so soon after his exposure, they said. You probably saved his life."

Yes, but she shouldn't have had to. "Where are the Greens?"

"Kicked off planet." Nils slid to his feet with a tiny sound of discomfort, then scrubbed at his arms while starting down the beach toward the waiting hotel. "They're talking about suing, you know."

Rahel blinked into the darkness as she followed him, glad for his pale complexion and ivory coat. Until the moons rose, those were the only parts of Nils that she could reliably see. "Well, good for the Greens. Maybe it'll give them something more constructive to do than attack apprentice proctors."

"How nice that you can be so cavalier."

"Sadena owns the planet," Rahel pointed out. Rocks bit and pinched beneath her feet, and the occasional little something scrabbled away out of sight across the sand. She missed the taste of sea spray against her nose and tongue. "As long as he doesn't violate Interplanetary Law, he can throw anybody off Uriel he wants to. Even us, if we're so lucky."

Nils stopped abruptly and turned about to stare. She nearly tripped over him in the darkness. "Not Sadena, Rahel," Nils said in a slow, un-

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derstanding voice. She wanted to hit him. "You. The Greens want to sue you for slander." He caught hold of her elbow and kept her beside him when he started walking up beach again. "This is exactly the sort of thing I'm supposed to be here to avoid."

Rahel snorted and pulled her arm out of his grasp. "Hell, if I'd known they were going to sue me, I'd have said a whole lot more of what I had on my mind."

Nils rubbed at his eyes and sighed. "No, you will not." He bit off each word with long-suffering precision. "Right now, the Greens are just posturing for the media. You haven't really said anything destructive—nothing they can build a case on, anyway. And if you stick to your work from now on—" He angled a warning glare up at her, "—preferably by staying underwater, we can probably finish out this contract without landing half of Noah's Ark in court."

"Would we anyway? I mean, is it slander if it's true?"

Nils shook his head, but obviously not in direct response to her question. "That isn't pertinent unless you can *prove* it's true."

How come she had to prove her insults, and GreeNet got to print anything about the Ark it wanted? Deciding she wasn't really in the mood for the answer, she continued her trudge up the beach without asking.

A bevy of shivering bellhops clustered around the entrance to the service tunnel, more than happy to converge on the proctors and usher them into the hotel. Rahel waved off Nils's offer to see about sending dinner up to her suite, and abandoned him with the bellhops at the service lift. That he held up a hand to stop anyone from following her surprised Rahel even more than his own willingness to stay behind.

The elevator glided with the same silent perfection as everything else in Sadena's hotel. For a change, it was nice to close her eyes and let the machinery do all the moving for her, nicer still to strip open her sandy skinsuit and drop it wherever she wanted as soon as she stepped through her suite's sliding door. Her hair felt gluey and crusted with salt, but she stopped just shy of the bathroom to stare in shock at the living area with one hand still splayed on top her head.

Flowers. The largest, most elaborate, delicate bouquet she'd ever seen replaced the oval coffee table. A half-dozen iridescent insects floated from blossom to blossom like fairy gems in search of nectar. Rahel crept up on the construction as though it were a tiger, and used two fingers to slip a platinum card from between two glowing Lunar orchids.

My sincerest sympathies for the attack on your apprentice. Please let me know if there is anything I can do.
F.S.

Rahel decided not to bother with a shower that night. She took only long enough to put on clean clothes and throw the flowers into the hall outside her door, then collected her water samples from this morning and carried them up to the pachyderm. A

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night in the pachyderm's bunk would feel good after this stuffy hotel, and, if she was lucky, the testing station AI could have all of the samples run before dawn.

The persistent beep of the pachyderm's intership comm irritated Rahel out of sleep what felt like only minutes after she went down. In reality, the chronometer at the pilot's station read 0816 when she finally stumbled over to slap the damn thing off, so she had to accept that it was well past sunrise outside and time to crawl back into the world of conspicuous consumption in search of answers. Leaning both elbows on the edge of the console, she keyed the comm answer sequence with a yawn.

A text-only message scrolled up the little screen in a swarm of turquoise letters that were disgustingly hard to take so soon after being asleep.

Mr. Kuvasc is doing well, although he still isn't able to handle visitors. He sends his greetings to you, and his thanks. You handled the emergency superbly—the medics seem confident he'll make an adequate recovery.

I was able to negotiate for custody of Mr. Kuvasc's skinsuit. It currently resides at a research facility on the mainland, and should be ready for your retrieval when you finally return to Noah's Ark. Simply let me know. Preliminary tests reveal traces of H_2S all throughout the suit's primary gas extraction system. So far, no one is willing to speculate as to how the H_2S was delivered, or whether the suit can ever be made user-safe again. I shall keep you apprised of any further developments.

I'm glad you were able to find some use for the flowers.

F.S.

Sadena may have been a bastard, but at least he could be a helpful bastard. Rahel deleted the message without sending a reply.

"Anything worth mentioning in last night's samples?" she asked the AI as she pulled on her shoes and dug a handful of breakfast packs out of the galley.

"No statistically significant evidence of contamination or disease," it told her. "Salinity displays an apparent tendency to increase in direct proportion to ocean depth, but I don't have enough samples to flag this trend as significant. The presence of shed cells and larvae does not deviate significantly from the predicted model for this time of year. Insufficient evidence exists to determine ephyrae population at this time."

Oh, well. It never hurt to hope for a miracle as long as you weren't really counting on one. "Log it as Uriel: Odarkan Sea, Sample Series #1. I'll bring some more to compile with it tonight."

"OK."

Sunlight bright enough to burn the fog off her brain met her outside the pachyderm's hatch. Taking one of the pseudo-food bars between her teeth, she squinted so tight she could barely see to lock down the ship before leaving it. By the time she'd finished and turned to find her place on the roof-

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top landing field, Nils and a nosegay of pastel security were half-way between the pachyderm and the same hop Rahel and Paval had taken to the Odarkan yesterday. She took another bite of her breakfast and waited for them to get closer than shouting distance.

Nils marked the transition for her. "Where the hell have you been all morning?"

Rahel glanced over her shoulder as though to make sure the pachyderm was still there, and peeled another breakfast bar. "In the casino, Nils. I just decided to teleport up here for breakfast." She scowled at him, dropping the ornamental innocence from her tone. "Where do you think I've been? Running yesterday's samples through the AI. I camped out in the pachyderm in case I needed to clarify something." That last part was a lie, but her reasons weren't really the issue right now.

"You should have told me you were going," Nils persisted, a little of the fire leaving his voice now that he had her in sight and undamaged. "When you weren't in your suite this morning, I thought the Greens had somehow got back on planet and taken you! I had security search the hotel from top to bottom—no one had the faintest idea where to find you!"

Well, *someone* had. Rahel wondered if Nils or the security personnel had thought to ask Sadena, and what reasons Sadena would have for lying to them if they had. Curious guy, that Sadena. His rationale for doing anything probably didn't mean very much to the average person.

Rahel offered Nils a breakfast bar in lieu of an apology. "Did you get my skinsuit?" she asked so they wouldn't have to linger on a subject she wasn't sure she wanted to pursue.

Making a face to prove he wasn't mollified by her sacrifice, Nils plucked the bar from her fingers and sighed. "I took it from where you left it folded on your dresser."

Not where *she'd* left it. When Rahel last looked, the skinsuit lay in a puddle of sand, with bits of flower and pottery shards all over the hallway floor outside. She nodded, though, a little amused by the discrepancy. "Helpful little bastard, isn't he?"

Nils raised his eyebrows in what looked like mixed question and concern. "Excuse me?"

"Never mind. Come on." Rahel clapped her arm across his shoulders to turn him toward the waiting hop, security closing around them to follow in their footsteps like a swarm. "We've got lots of work to catch up on yet."

She'd just feel a whole lot better about the project if Sadena wasn't putting so much charm and effort into trying to curry her favor. The more he tried to convince her that her opinion really mattered to him, the less, Rahel knew, he was actually looking forward to hearing it.

The water didn't feel as warm and welcoming today. Bracing her knees against the keel of the skate, Rahel gripped the boarding ladder with one hand while she accepted a spare bandolier of sample jars from Nils with

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the other. He looked surprisingly businesslike and sturdy out here under the open sun, not at all like some stuffy lawyer who wore gloves to prevent callouses and had to clip his nails to keep them short.

Rahel pushed away from the boat and slipped one bandolier crosswise over the other. The two together were barely heavy enough to register on her BCD control. "I'll keep the comm line open," she said, drifting back from the skate in preparation to go under. "Make sure you acknowledge my transmissions, or I'll think you've fallen asleep up here."

Nils nodded, brow wrinkled somewhat unhappily. "What should I do if I lose contact with you?"

"Sue somebody." She smiled at his annoyed grimace, and dropped down under the water. "I'd suggest Sadena. He's probably good for a higher out-of-court settlement than the Greens."

Nils answered her comment with a patient sigh.

Dumping her BCD, she floated smoothly down toward the carpet of jellies with a sheen of bubbles glistening the water above her. The drift into darkness wasn't nearly so pleasant today. Darting shadows snagged her attention with little stabs of adrenaline even though she couldn't have told herself what she was looking for. The taste of each breath registered consciously on her brain, and every minor adjustment in the skinsuit's gas extraction system made her lungs freeze up for a heartbeat while they waited for disaster. Even checking, checking, and rechecking her O_2 levels accomplished nothing except to leach all satisfaction from this temporary privacy. She didn't even realize she'd reached the jellyfish swarm until the first gauzy body pulsed beneath her hand.

"OK... I'm at the jellyfish interface."

"I know," Nils voice said, sounding closer, even, than it had when she'd talked to him on the surface. "I can see your reflection on the remote sensor." Rahel hadn't expected him to be clever enough to use something like the skate's mapping system to keep track of her. "Gee, I had no idea jellyfish would look so... squishy from a distance."

Rahel smiled and felt for a path between the bodies. "Well, squishy is what jellyfish do. I'm going to pull a whole set of samples to augment what I brought in yesterday, then drop lower to cover Paval's sector." She pulled her knees against her so tightly that the sample jars on her belts pressed into her stomach. "Try to make yourself useful while I'm gone."

"Be careful."

The honest concern in his words surprised her. "I'll try," she said seriously. Then she sank into their tendrils and let the milk-white world of the jellies lull the surface world from her mind.

Their silent, graceful peace crept over her more readily than she expected, but couldn't find sufficient purchase in the jumbled texture of her worries. She meticulously collected samples from various depths and various locations, making sure to catch any particulate matter or jelly

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sloughings that might prove significant. Wending her way delicately in between ruffles and frills, she even went to the effort of siphoning water from within the bells of both egg-heavy and empty adults without disturbing their reproductive systems. This, then, led to an idle thought regarding how many ovigerous medusae were actually floating with this swarm, and that in turn led to an impromptu census of egg clusters glued to the bellies of the adults.

Rahel felt a little funny, swimming from jellyfish to jellyfish and lifting up their skirts to see who was pregnant. Considering stellar jellies weren't sexed in any Terran sense, any of the adults could have—and should have—been able to carry eggs as long as they'd had enough genetic exchange to ensure a viable clutch. The fact that barely one in ten appeared to be carrying seemed unreasonable. Rahel paused, letting the jellies swell and throb away from her as she chewed the inside of her jaw.

Season? she wondered. Food? Hell, maybe the population was too inbred, and something in the stellar jelly's genetics could recognize when it had a bum deal going. She pushed herself down below the lowest tendrils and blew a frustrated sigh. It could be anything from lighting to water temperature to a drop in ambient salinity, and she wasn't going to figure out which while floating around under here. It might have helped, of course, if Sadena had ever allowed a full-scale study of the jellyfish before now. But no—he hadn't wanted to disturb his resort's primary source of tourist trade, even for the sake of science. And now both his resort and the stellar jellyfish might have to pay for that selfishness.

"I don't know if it makes any difference, but I'm roasting up here."

Rahel glanced skyward at the sound of Nils's voice, grinning a little despite herself. Somehow, he managed to make everything sound like some kind of personal attack on his time. It must have been a lawyerly skill. "All right, I hear you." She slipped the bandolier of completed samples off her shoulder while she wriggled up through the milling jellies. "You still got me on your sensor screen?"

"You're a lot more solid than the jellyfish—you're hard to miss."

"You've got a sample pack coming up directly above my position." She extended her arm up over her head and pressed the sample belt's thumb tab. A brilliant yellow balloon blossomed at the shoulder seam, tugging the bandolier out of her hand and upward as if pulled by a string. She watched it disappear into a blur against the surface light. "Log those as Uriel: Odarkan Sea, Sample Series #2. Then put them in my equipment pack and *don't touch them again.* Got it?"

"And here I was planning to line them all up on the seats and play scientist with them until you got back."

Rahel eased back down past the jellyfish barrier again. "Don't get smart with me, Oberjen."

"I can't help it," he replied drily. "I'm a lawyer—it's my job to be smart." He went on more seriously

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before she could contradict him. "We've got your samples. Are you sure you don't want to come up for a suit check before you start the next series?"

No, she wasn't sure. The whole thought of doing work in Paval's sector felt like walking on someone's grave. "What good would surfacing do?" she asked aloud. "I checked the suit six times on the hop coming out here, and we don't know what we're looking for anyway. My O_2's good—" She sneaked a look at the reading, just to make sure. "And I know to expect trouble." She tossed hands up in a shrug even though there was no one in sight to appreciate it. "I think we're as safe as we get." And wasn't that a depressing thought? "Just make sure you take care of those samples."

"You take care of yours."

She nodded, the way she always did when Saiah bothered to tell her the obvious. "Yes, mother." Then she pushed off against the water behind her, and started her first swim-by of the sector.

Rahel worked her way slowly back and forth across the levels, the lantern at her waist carving a fat tube through the dim waters ahead of her. Flashes like flitting coins winked on and off in the slashing light, little fish-things stealing glances at the new intruder; diaphanous ripples of tissue danced in slow blindness away from disturbances they could barely sense with their primitive jellyfish nerves. As Rahel bottled sample after sample on her way toward the sea floor, the O_2 monitor at the edge of her mask seemed to swell in size and importance. She found her attention caught by it every time she looked up from capping a flask, and her breath stopped with each glance—it *must* be some anomaly in the levels that made her look so suddenly.

Of course, the gauge sat placidly at the 21 percent she'd originally set it for. The only thing fluctuating here was her blood pressure. And her attention to the job at hand. Jamming the latest bottle back into its holster loop, she aimed herself downward with a disgusted sigh.

What looked like gnarled, scattered fragments of crab shell misted into being below her, impossibly huge, as big and broken as boulders, with edges blurred by time and moss. Rahel widened the beam on her lantern, and the fur of pearly velvet on each rock ruffled in response to her movements through the water. She pulled herself to a clumsy stop.

"Oh. . . ."

"What?" Nils's voice cracked nervously in her ear. She could almost picture him scrabbling to peer over the edge of the skate as if that would somehow help him. "Rahel, what is it? What?"

"Nothing, Nils! Calm down." She drifted off to one side of the rocky heap, shining her light all down its length, kicking gently to verify its width and height. "It's just. . . ." Amazingly tiny little creatures reached up from the rocks to stroke the water with pink feather dusters, as unlike the huge, graceful adults as a zygote was unlike a human. Rahel lowered her mask to within bare centimeters of the polyp mat, and still she could

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only just make out the individual branches of their bodies. Occasional one-celled ephyrae twitched away from the budding stalks like specks of dust on independent breezes.

"I just came across the polyps," she finally remembered to say. She uncapped a sample flask while she talked, trying hard not to catch many newly shed ephyrae. "The Odarkan's coastal shelf drops off here, and most of the polyps have set up shop on a broken spur of rock about . . . ." Her light searched for an end out in front of her. ". . . I don't know. Maybe a hundred meters. I can't see where it lets off."

"According to Jynn's topo map, the actual lip only goes another fifty-seven meters before meeting up with the shoreline again." There was a pause marked by a terse, muffled exchange while Nils checked something with Jynn. "A lot of that fifty-seven is deeper than your current position, too. The Odarkan apparently doesn't have much in the way of shallows."

Rahel twisted to turn her light over the edge of the lip. "Yeah, it drops off pretty steeply here. I can't tell how—" She froze with the lantern aimed between her feet. "What the hell . . . ?"

"Rahel, don't do this to me."

The rock a dozen meters below looked as though it had been shaved. Remnant podetiams clung to the surface like gooey white blisters, but no carpet of stalks combed the water for microbes, no flecks of bright color revealed budding polyps crowned with umbrella platters of ephyrae. Above the line of destruction, another handspan worth of polyps dangled limply, still attached to their gripping feet, but obviously not still alive. "Something's the matter down here."

"With you?" Nils asked testily. "Or with the jellyfish?"

Rahel wasn't sure if she appreciated his concern, or was just annoyed by it. "The jellyfish," she said as she lowered herself over the drop-off and started downward. "The polyps, at least. About ten meters below my current position, we've got a massive die-off. I'm not going down that far," she was quick to add. "But I want to get a better look at the environment while I pull some water samples from that depth. I've got a reach-stick that'll go three meters."

"If it's some kind of free-floating toxin, are you sure that'll be far enough away?"

Irritation jabbed at her, colored with embarrassment when Nils's worry only made her glance again at the oxygen gauge near the edge of her mask. She cut off whatever sharp reply she'd meant to make when the oxygen level dropped from 18 to 11 percent in the moment that she watched.

An instant later, she'd rocketed five meters back to the top of the polyp bed.

"Well?"

She clapped hands to both sides of her mask and frantically sought out the oxygen gauge while her lungs begged her to take another breath. But not yet, not yet—not until she knew what they'd done to her. She wanted to die knowing what the bas-

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tards had done.

The O_2 gauge glowed a helpful green, telling Rahel that levels were considered optimal even before she specifically identified the reading of 21 percent. Her breath gusted out of her as though she'd been punched.

"OK." She was surprised at how thoughtful and calm her own voiced sounded in her ears. "No, Nils." She glanced back down through the darkness, toward the drop-off and the carpet of dying cells. "I don't think three meters will be far enough."

"Oh?" The lawyer sounded disgustingly eager. "Did you find something?"

Rahel pushed herself to lie even with the ledge through sheer force of will, digging her fingers into the muddy floor as if that would somehow hold her from toppling over into oblivion. "I've at least found the hint of something. Sadena's got a problem with his water."

"His water?"

She pointed, then remembered that Nils couldn't see her and pulled her arm back to her side. "Down where the die-off occurred, my gas exchange system registered a drop in available oxygen. I thought there was something the matter with my suit, but when I got back up here, my oxygen level was back to normal."

"Meaning what?" Nils asked, his voice sounding almost annoyed with confusion. "That there isn't oxygen for the suit to process in the water ten meters below you?" Something that his tone said he found distinctly unlikely.

"Very good, counselor." She rolled onto her back and sat up. "Would you like to go for double or nothing?"

"But I don't understand." Nils was obviously too disconcerted for recreational betting. "I thought water was always one-third oxygen—H_2O. How can you not have oxygen when you're in the middle of an ocean full of water?"

Rahel sighed and looked up toward the surface, wondering how easy this would be to explain with forty meters of sea between them instead of a half-full bucket of water and two glass bell jars. "Because that's not the type of oxygen I'm talking about. The oxygen in H_2O is busy being water, and you can't get it to *stop* being water without running an electric current through it." She peeked at the O_2 gauge in her mask to ward off a sudden shortness of breath. "What I'm talking about is dissolved oxygen—little bits of oxygen that aren't hooked up to hydrogen being water. When there isn't any of that in the water, the suit can't extract it out. That's why skinsuits don't work for long in a closed system like an aquarium, or why they're not useful in swamp studies. . . ." Whatever point she'd meant to make evaporated from her brain, burned away by the sudden brightness of her understanding.

"That still doesn't tell me why this water's lacking oxygen."

"Because of the swamp," Rahel said excitedly. She pushed up to her knees so quickly that she nearly lifted herself into a tumble. "Uriel's swamp water is anoxic—it doesn't have enough dissolved oxygen in it. That's why it's stagnant, why not much lives in it,

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why it smells bad—*Nils!*" She clapped a hand to the top of her head. "That's where the hydrogen sulfide came from! Paval's suit extracted it out of the standing swamp water!"

God damn. The Greens had a slander case against her after all.

"Wait a minute." Nils cut across her ranting impatiently. "Are you telling me you think swamp water is leaking into the Odarkan and killing the stellar jellyfish? How?"

Rahel shook her head and felt around the back of her belt for the reach-stick. "Dunno." She looked around as though that might enlighten her while paying the stick out to its full three-meter length. "Maybe by flowing along a rift in the shelf platform. Or maybe Sadena's pumping someplace and didn't feel the need to tell us. However it's getting here, though, it's coming through in pretty large quantities."

"And you're *sure* the water's coming from the margin sloughs?"

"Not 100 percent sure." Rahel had to be honest about that or scientific methodology wasn't worth a damn. She clipped a sample flask to the reach-stick, then tied a cable to the other end before lowering it over the edge into the anoxic darkness. "But there's one real quick way to find out."

The churlish, rotten stench of hydrogen sulfide belched up at Rahel when her reach-stick broke the surface of the margin slough's morass. She turned her face away with a little cough, and signaled the stick to pop caps on all the specimen jars arrayed along its length. Even a cloth filter mask didn't do much to keep out the smell, and nothing did much against the insects. Rahel spent half her time batting buzzers and noseeums away from her eyes, the other half trying to get the lids back on the sample jars so she could retreat inside the pachyderm. She'd never been more grateful for water-tight surgical gloves and hip-deep waders.

"Is nature always this smelly?"

She glanced back at Nils as she withdrew the reach-stick from the filthy water. With one hand braced against the pachyderm's open hatchway and the other holding a filter mask against his mouth, he looked like an unwilling attendant at an autopsy. Rahel doubted she could have convinced him to step down into the swamp water even if she needed him to.

"This is about as bad as it gets," she admitted, wading back to join him. "Methane from large ungulate farts is pretty nasty, too. But it explodes, so at least you can have fun with it."

Nils stumbled aside to let her climb past him into the pachyderm, then keyed the door shut once she was inside. "You've got to be joking."

Rahel didn't see the point in enlightening him.

Jynn looked up from the pilot's station when she entered, but didn't stand or say anything, only offering a nervous wave in greeting. Rahel acknowledged him with a nod. He'd insisted on piloting the pachyderm from the Startide to the sloughs because neither Rahel nor Nils was cleared by Feles Sadena to fly within

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Uriel's atmosphere. "Mr. Sadena wouldn't want me to start ignoring his own rules now, ma'am." The fact that Rahel's mobile laboratory was even more rigorously non-impact than any of Sadena's aircraft wasn't part of the equation. "Either I'm responsible for what flies outta here and where, ma'am, or we go to Mr. Sadena and you explain to him what you want to do. It's not my place to make the rules."

In the end, Rahel was just as glad to have Jynn along. He proved remarkably adept at keeping the pachyderm no higher than the skin of the water—"You been down underwater, ma'am. We can't take you no higher in the air than this."—and having him to pilot let her pull her gear together before they arrived at the sloughs. Unlike Nils, Jynn also seemed to feel no need to understand every little step of what she did along the way.

"Computer." Rahel stopped in front of the pachyderm's testing station and started unclipping sample jars one at a time. The inside of the ship already stank from the wet of her footsteps, and she despaired for a moment of ever removing the smell again. "Get ready for another collection set. Log this one as Uriel: Southeast Margin Slough, Sample Series #1." She telescoped the reach-stick, tossing it into a basin for later cleaning, then stripped off her gloves and dropped them carefully into the disposal. "I'll want a full work-up on resident chemosynthetic bacteria using the same criteria you applied to Odarkan Sea Series #3. Run a split screen comparison of the two series, and alert me as soon as you're done."

She wiped the bottles while waiting for the reply, but still had three to go when the AI reported, "I can have general population figures on both series in six minutes sixteen seconds."

"Great." It took almost that long to pipette out the samples and slide them into the machine. "Have a good time."

The AI clicked as it received them. "OK."

Nils moved around in front of her as she bent to unstrap her hip boots. "What exactly will this run of tests tell us?"

"It'll tell us whether or not the margin sloughs and the Odarkan Sea share the same bottom water. If they've got the same bacteria in the same populations, it's a pretty safe bet the water's all coming from the same place."

"Wait a minute. . . ." Nils offered his elbow as a brace when she stepped one boot on the toe of the other for leverage. "I thought you said nothing could live in anoxic water."

Rahel accepted his outstretched arm. "Nothing *you'd* ever notice can live in anoxic water," she amended, jerking one foot loose with a hopping stumble. "But there are various one-celled organisms that get their energy from compounds other than oxygen, so they don't care how stagnant the water is. They live in the water in different percentages at different depths, depending on how much oxygen has already been eaten up, and what compounds are still left to munch on." She freed her second

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foot, then padded barefoot away from the puddle that had gathered under the waders. "Those are the bacteria we're looking for."

Picking up the boots one in each hand, she slipped sideways past Nils to carry them hastily into the bathroom. She could always rinse them off later. Or, better yet, get one of Sadena's ever-helpful hotel staff to come clean the whole inside of the pachyderm as though it were a guest room. Nils handed her the basin with the reach-stick and used glassware, and she slid it into the bottom of the shower stall with the boots.

"Ma'am?"

Rahel paused in hauling mop rags out of the cleaning supplies. At the front of the pachyderm, Jynn stood poised on the step between the pilot's area and the rest of the ship, his dark face naked with concern. He came down to take a rag from her when she moved out to join him.

"Ma'am, I didn't mean to be listening, but I couldn't help but overhear." He dropped the rag across the biggest puddle and moved it around with his foot. "Am I understanding right? If you find the same bacteria in both the jellyfish water and the swamp water, that'll mean you're right—that water leaking out of the swamps is what's causing the jellyfish to die?"

Rahel nodded, kneeling to sop up the trail of footprints leading from the testing station to the door. "That's right, Jynn."

The plot nodded slowly. "Ma'am, is this something Mr. Sadena can fix?"

She rocked back on her heels and looked up at him. Nils, sitting in the chair at the testing station, looked back at her without offering any frowns or eyebrow lifts to try to tell her what she should say. When even the lawyers are quiet, you know you're in trouble.

"There's a good chance," she finally admitted. "First we'd have to locate where anoxic water's draining from. If it's a point source—like an old estuary, or a fissure in the bedrock—we should be able to divert the water and aerate it before it hits the Odarkan. Add oxygen and bingo! No anoxia."

Jynn nodded. "But if it isn't a point source?"

"Well, that's a little harder." Rahel planted hands on her legs with a sigh. "If it's coming off the entire slough shoreline, it'll take a lot more engineering to aerate it all. You could still *do* it, but Sadena's gonna need a geological investigation before he can even think about it, not to mention some estimate of the environmental impact that kind of intervention would have on the sloughs." She shook her head. "That size project would take a hell of a lot of money."

Jynn lowered onyx eyes as though in thought, but a polite chime from the testing station postponed any other questions he might have asked. "I have the preliminary sample results for Odarkan Series #3 and Southeastern Margin Slough Series #1."

Rahel climbed to her feet and waved Nils out of the testing station chair. "Put it on screen."

"OK."

Neatly carved wedges of statistical

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data grew up on either side of the screen, snake lines of blue, yellow, red, and green chasing after bits of information in an effort to pin down primary indicators. Rahel slipped into the seat, searching out the few specific microbes who would most readily tattle on their wandering brethren. Her hand stopped with its index finger pinning the Odarkan Sea's iron reducers, her pinkie angled down to find the margin slough's sulfates. "This can't be right."

Nils jerked beside her. "What?"

"Chemosynthetic bacterial concentrations are correct within 0.0015 percent."

Rahel hit the side of the machine with her hand. "Not you."

"Rahel, what is it?" Nils squirmed unwillingly aside as Jynn pushed in beside him. "Isn't this what you were looking for?"

"Ma'am, does this mean we have a problem?"

Rahel snorted and tapped the top of the screen. "Hell, Jynn, we already had a problem. But see this?"

Both men leaned forward to glance at where she pointed. Jynn only nodded, but Nils asked, "What of it?"

"Basically, everything up here at the top of the display is from the highest water, water that still has some oxygen in it." Rahel moved her hand to the lower part of the display. "Everything down here is from the bottommost water that doesn't have any oxygen left at all. Anything that can live up here—" a single tap above, "—can't live down here." She rested her hand on the bottom of the screen again. "And vice versa."

"Ma'am. . . ." Jynn touched the display alongside her, as though feeling out the printed pages of a book. "These numbers don't look like they match."

Rahel sat back in her seat with a sigh. "That's because they don't." Nils groaned softly behind her. "Look at the percentages of methanogens here at the bottom. These guys can only live in *the most* stagnant water—oxygen can't even *think* about sharing the same water space. If I took a cupful of that swamp water out there and poured it into a glass of tap water, the oxygen in the tap water would wipe out the methanogens in a matter of seconds."

"But. . . ." Nils reached over her shoulder, tracing a line from one side of the screen to the other. "There's 77.65 percent methanogens in the Odarkan water, and only 3.37 percent in the slough water." He angled a look down at her, and Rahel could see the question in his frown that he wasn't sure he was supposed to ask.

"The biggest bacterial population in the slough water is sulfur reducers—" Rahel pointed to the wedge of microbes that gifted the sloughs with their lovely aroma, "at 69.89 percent. But the Odarkan water only carries 15.02 percent sulfur reducers, and they're *both* low on iron and nitrogen reducers."

"Ma'am, it sounds like you're saying the Odarkan Sea has even less oxygen in it than these margin swamps."

"Nonsense." But Nils sounded more brusque than usual, and leaned down to half look at Rahel as he

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talked, as though quietly requesting her approval. "It ought to be like with the glass of water—*more* oxygen after the slough water mixes with the Odarkan, not less."

Yes, it should have been. A horrible trickle of thought wormed its way into her brain—so terrible, so hopeless that she wouldn't even let her mind give it words. Picking out a random selection from both series of samples of something that looked vaguely like Terran *desulfo vibriens*, she said, very calmly, "Computer. I want a genetic blow-up and comparison on these two populations."

For a gene spin, it took almost no time at all. Eleven minutes. Maybe twelve. When the spin finally popped up to supersede the population statistics on the testing station's screen, it proved a wonderfully complex weave of structure and purpose for such a tiny, straightforward organism. Rahel walked quickly through the ladders of their chromosomes, not even taking time to marvel at their design. Her stomach tightened and her mouth grew sour with each inconsistency that passed beneath her hands.

"These bacteria aren't related," she finally admitted.

Nils shook his head at her, then at the genetic display. "At all?"

"Not for a couple billion generations." Rahel wanted to look at him, wanted to make sure Jynn understood what they were talking about here. But she couldn't pull her eyes away from the screen, with its damning statistics and mismatching bacteria. "Nils, I was wrong. The Odarkan bottom water can't be coming from the margin sloughs."

Nils sighed with the frustration of a man already left several steps behind in the conversation. "Then where *is* it coming from?"

Rahel turned her chair to face him, including Jynn by the sheer fact of his proximity. "Remember when I said someday I'd explain anoxic organic decomposition to you?" she asked the lawyer. When Nils only nodded, she waved him toward the floor. "Sit down."

They didn't start back to the Startide Hotel until dusk. By then, Rahel had guided Jynn all over the landlocked Odarkan before having him skim the pachyderm to a dozen different locations across Uriel's ocean surface. It had been a long and silent day. They ran out of sample flasks while there were still places Rahel wanted to visit, Nils gave up trying to separate slides when they ran out of table space to stack them, and Rahel's limbs felt weak and rubbery from too many hours underwater. She let Jynn turn back for lack of anything more productive to do. At least they had data enough to support whatever report Noah's Ark finally decided to deliver, not to mention enough methanogenic bacteria to open a sizable zoo.

Jynn left them at the foot of the Startide's great front steps. "I don't want to take you up to the roof while I park this, ma'am. You understand."

To a certain extent, she did. Another part of her would rather have courted the bends than have to trudge up a two-hundred-meter flight

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of stairs dogged by every breed of reporter known to man. She groaned and stepped awkwardly down from the pachyderm's hatch, obscurely glad when Nils hopped out beside her. Maybe he could distract the godless hordes with legalspeak while she made a slow-motion getaway.

"Proctor Tovin, the Green has officially announced its intention to take legal action against Noah's Ark. Do you have any comments in your—?"

"Are there any new findings today regarding allegations that Mr. Sadena—?"

"Proctor Tovin, on whose authority—?"

"Have you heard anything about Paval?"

That last came with a hard grip on her elbow and the sudden heat of a body very close by. Rahel wheeled, jerking her arm back with a snarl, but stopped herself just before letting the hateful words boil over. Keim pulled her hand to her side as though only just realizing how intrusive she'd been.

"I just wanted you to know—I'm really sorry about what happened." Somehow, the respectful intimacy of Keim's voice carried over the tumult more clearly than simple shouting. "What they did has nothing to do with conservation or love of nature, and you and I both know it. I hate that they're a part of what I stand for."

Rahel sighed and ran a hand through salt-encrusted hair. Five steps below her, Nils was insisting on courtesy before he'd acknowledge any netlink questions. "I'll give you a scoop." She was impressed when Keim didn't dive immediately for her notebook. "What happened to Paval—your Greens didn't do it."

The reporter's eyes widened, and one hand splayed wide as though longing to type. "You're sure of this?"

Rahel nodded. It seemed only fair to give GreeNet first shot at the story, since they were suing her and all. It was the closest she could come to an apology. "You'll hear the details when I know them. But tell your bosses I was wrong."

That was a phrase she expected to repeat often over the next few days.

The Startide's lobby somehow looked even larger and more empty than on the day they arrived. Rahel shivered a little when a bellhop finally sealed the door behind her and Nils, and let silence clap shut around them like a vacuum. Here they were, she realized, encased inside a replica of nature that had no idea of the full power of what it tried to represent. Caught between the destructive nature of the mild, patient ocean outside and the conspicuous hubris on display in here, Rahel's concerns suddenly felt very ridiculous and small.

"Don't look now."

She looked where Nils pointed, then couldn't even reach out to take the note when Huan glided to a stop in front of them with waldo outstretched. "The guy's good," she allowed as Nils accepted the piece of paper and unfolded it into a square. She guessed what it said even before Nils scoffed with disgust and held it out for her.

Please do me the honor of stopping

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by my suite before you retire.

F.S.

Rahel took the note and crushed it between her palms.

"What are you going to tell him?" Nils asked.

She sighed and followed Huan when the Newborn pivoted to retrace its winding path across the lobby. "The truth."

"Proctor Tovin, Proctor Oberjen. Thank you for coming by." Feles Sadena smiled politely, lacing long cinnamon fingers over one knee and sitting back in his tastefully polished coral chair as though pleased with himself for having greeted them so well. Behind him, Jynn stood with hands behind his back, dark eyes slightly averted. "I know you must be tired after such a long day in the sun." Without any overt signal from Sadena, a service drone glided in with a tray of steaming beverages.

Rahel neither smiled nor glanced at the waiting coffee. "Do you know anything new about Paval?"

"Yes. . . ." Sadena pursed thin lips in gracious concern, reaching for one of the tiny cups. "Yes, of course. Mr. Kuvasc is doing extremely well." It was apparently already brewed and sweetened to his tastes—he took a sip without waiting for the contents to cool. "He's been asking for you."

Rahel's stomach squeezed with unexpected guilt, only to burn a moment later when anger flashed up to replace it. "I was finishing our work. Mr. Kuvasc understands." And damn Sadena for trying to unbalance her with such a heartless ploy.

"Speaking of your work. . . ." Sadena siphoned off another decorous sip. "I'm told you've located the cause of all my jellyfish problems."

Rahel flicked a look at Jynn over Sadena's shoulder, but the pilot dropped his gaze without meeting her eyes. "If your man told you about the problem," she said, not caring that her tone made Jynn flinch as though she'd pricked him, "then maybe he also told you there's nothing anyone can do about it."

Sadena replaced his cup on the tray, managing to glance back at Jynn and disregard him with a single gesture. "Proctor Tovin, Jynn is merely an informant. If he didn't believe in impossibility, he might have some more meaningful job. I, on the other hand, am a man with a great deal of money. I have found that, in the main, impossibility is highly overrated." He sat back again in his chair and fixed her with unfeeling eyes the color of iron. "I would like you to tell me yourself how you see the situation."

"Your ocean ecology is screwed up and there's nothing anybody can do about it."

Nils stirred beside her, shooting her a sharp, reproving glance. "Uriel's oceans are becoming stagnant, Mr. Sadena," he said, ignoring Rahel's returning scowl. "It's part of the planet's natural global cycle, and right now it's smothering the stellar jellyfish. Eventually, though, it will smother almost everything else in the water. I'm sorry."

Sadena studied Nils with the very faintest of frowns wrinkling his high

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forehead. Then he tipped his head toward Rahel and asked the question with his eyes.

She thought about pacing to disguise her distaste of his attention, but made herself match his stare without flinching. It felt like sharing handclasps with a corpse. "Uriel's a greenhouse planet," she told him in her most businesslike tone. "That means you've got no polar caps, which means you've got no deep thermohaline currents. You've got three puny natural satellites—that means no significant gravitational stresses, and that means no tides. So basically put, Mr. Sadena, Uriel's ocean water doesn't move around. You get a little bit of chop at the surface due to wind movement, but that only oxygenates the upper level. The rest of the ocean has to collect oxygen through diffusion. That isn't very fast, and a lot of things can screw it up. Like when crap falls down from above—"

"Crap?" Sadena interrupted delicately.

Rahel waved her hands in ill-tempered impatience. She wasn't interested in playing to his sensibilities. "Dead algae, dead fish, dead birds—anything organic that sinks from the ocean surface to the bottom. Once organic stuff gets down there, it rots. Rotting uses up oxygen. If you've got more organic stuff floating down than you have oxygen diffusing—which in Uriel's environment isn't too hard—your organic rot uses up all the oxygen. Without oxygen, the organic waste can't rot, so it starts to build up. Once it builds up high enough to touch oxygenated water, it starts rotting again. After a while, it uses up all that oxygen, too, and so on, and so on."

Sadena nodded once, a cordial acknowledgment that he was paying attention. "And you say this is happening all over the planet?"

"As near as we can tell. You noticed it in the Odarkan Sea first because that's a much smaller body of water than the entire ocean, and because you pay special attention to the wildlife there. Who knows how many deepwater species in the main ocean you've lost without anybody noticing." She could tell from Sadena's dismissive shrug that the thought disturbed her more than it did him. "You'll need a Geological Survey ship if you really want details on a planetary scale," she went on, making no effort to hide her dislike of him. "But I can tell you that every bottom water sample I pulled today indicates the development of a major anoxic event."

Glints of dispassionate thought moved in Sadena's dark eyes as he steepled fingers beneath his chin. "But the presence of my resort," he asked carefully, "of *any* of my resorts, has nothing to do with this development?"

Rahel snorted. "Even you couldn't produce enough garbage to turn an entire ocean stagnant."

"But at some point—" Nils moved to sit on the sofa directly across from Sadena, his hands clenched into a bundle of worried energy in his lap. "At some point, all the methane gas, and garbage, and hydrogen sulfide that's building up at the bottom of

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the ocean—" He glanced at Rahel for verification, then continued talking without actually waiting for her response. "When that needs to escape, Mr. Sadena, it has nowhere to go but up. The rotten bottom water is going to rise to the surface, and all the surface water will sink down below, and Uriel's oceans will put out a cloud of gas so poisonous you'll have nothing left alive within three kilometers of your beaches."

Ever since she'd explained the result of anoxic turnover to Nils, he'd been obsessed with making sure Sadena understood the details. Rahel, on the other hand, knew Sadena only needed to understand one thing "Your ocean ecology is screwed."

"How soon can I expect the planet-wide repercussions Proctor Oberjen describes?"

"Like I said, you need to talk to geologists about that." Rahel tossed a shrug and guessed anyway. "Five thousand years? Five million?" In the lifetime of a planet, both were equally imminent, barely a heartbeat away.

Sadena's little chuckle of amused relief disagreed. "Thank you for your report, Proctor Tovin. In the meantime. . . ." He waved away the service drone, causing Jynn to dance back several steps to keep from being run over. "I believe our business here is done. Noah's Ark's services are no longer required on Uriel. You may, of course, make yourselves comfortable at my expense until Mr. Kuvasc is ready to travel, but you needn't trouble yourselves with any additional—"

"But . . ." Jynn looked startled with himself, as though he hadn't expected to hear himself speak. "But what about the jellyfish?" he asked in a little-boy voice.

Sadena's hand curled about the arm of his chair, and he sighed, very softly. It was the first honest sign of emotion Rahel had seen in the man. "Jynn, I'm sorry to have kept you from your duties. You may consider yourself excused."

"No, sir. . . ." Jynn rounded Sadena's chair in a few uncertain steps, darting his attention between Rahel and his employer as though unsure to which one he should appeal. "Are you just going to talk about it and call it done?" He finally settled his gaze on Rahel. "Ma'am, what about the jellyfish?"

"Jynn. . . ." Her back hurt, her lips tasted like tears, and the skin of her face and hands felt dry enough to peel. Even if she knew how to say what the pilot wanted, she hadn't the strength for it right now. "I'm sorry."

"But you got brought here to do *something,*" he insisted. Big hands implored her for help as they reached out to her. "Can't you take them back with you? Just some of them. Keep them, and breed them the way you do other animals. That way there'll still be some left to bring back when the oceans get right again."

Rahel gently shook her head. "Noah's Ark doesn't work that way. We aim our reproduction efforts at animals who were pushed to extinction by unnatural forces—people, usually," she added, glaring once at Sadena. He returned her stare with impassive disinterest. "But when things die in nature. . . ." She wished

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Jynn would blink and clear the tears that had gathered in his eyes. "Whole species die and get replaced all the time. They always have. If it isn't right for humans to wipe out an animal that nature intended for survival, then it isn't right for us to save an animal that nature meant to destroy." When Jynn didn't say anything for what seemed a very long time, Rahel asked softly, "Do you understand?"

He jerked to face Sadena in answer. "You could hire Noah's Ark to do it, couldn't you, sir? You're always saying you can do anything with the jellyfish you want to—"

"And, indeed, I can," Sadena cut the pilot off impatiently. He reached around Jynn for another cup of coffee, and his face darkened slightly when he realized the serving robot was no longer by his chair. "However, I am not interested in entering into any such arrangement with Noah's Ark at this time."

Jynn shook his head slowly. "But *why?*"

"Because," Rahel caught Sadena's eyes with her own when he glanced at her, "Mr. Sadena isn't actually interested in preserving Uriel's jellyfish. He never has been."

The languid composure with which Sadena shifted to drape one knee over the other made anger rise up into Rahel's throat so hot it was all she could do not to bite him. She suddenly understood why Paval hadn't been able to restrain himself from beating the righteous superiority off those Green faces.

"Let me tell you something, Proctor Tovin," Sadena offered, the voice of a man with a great wisdom to impart. "I own Uriel. I did not buy it to preserve it, I bought it to exploit it. I preserve the planet as aggressively as I do because I cannot exploit what I do not have, and because it is just bad business to let consumers believe I shit where I expect them to vacation." Whatever passed for sensitivity drained from his face, and the cold impatience of a businessman darkened his eyes. "My interest in Noah's Ark was never about jellyfish, Proctor Tovin. It was about publicity, and reputation, and considered self-interest. But it was *never* about jellyfish."

Jynn left, very quietly, through the same door the service drone had used to come and go. For just a moment, Rahel wasn't sure if Sadena's show of disdain had really been aimed at her, or at his insubordinate employee. It probably didn't matter—she doubted Sadena would see either of them again.

The sofa creaked softly as Nils leaned forward in preparation to stand. "I think that's all we need to cover right now, Mr. Sadena," the lawyer said politely. "I'll be in touch with your financial division—"

"Don't bother."

Nils twitched a panicked look at her, but Rahel refused to take her eyes from Sadena. "I beg your pardon?" Sadena inquired.

"Noah's Ark won't be accepting a fee for this safari."

"*Ra*-hel!" Nils scurried around the end of the sofa as if to protect her from herself, all his lawyerly instincts no doubt soaring with his blood pressure. "You can't just renegotiate the agreement at this late a date!"

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Rahel stepped to one side so she could keep eye contact with Sadena without leaning over Nils. "Read your Ark contract," she told the lawyer. "While we're out on safari, *I'm* your boss—that means I can do anything I think necessary." She pushed Nils back into his seat with a glare. "And I'm telling you to shut up."

Nils sank onto the cushions with his forehead in his hand.

"I'm good for the contracted amount," Sadena assured them. He didn't sound particularly offended, though.

Rahel almost grimaced with disgust. "I'm sure you are. But if the Ark accepts payment from you, we're bound by all the elements of your contract—including the gag clause that says we can't go public with the details of our relationship with you." She shook her head grimly. "I won't have GreeNet posting that Noah's Ark will tailor its data to suit high-paying customers, and I *won't* have you implying that we knowingly came here to whitewash your operation. You'll pay for our expenses—including Paval's medical care and our upkeep while we wait for him—but you won't pay the usual consulting fees, and you won't interfere if we choose to make our investigation here public."

"Considering your data reveals no misconduct on my part—" Sadena spread his hands with a pleased little laugh. "In fact, you prove I'm completely justified in not spending a credit to rescue Uriel's environment. I'm more than happy to let you spread the word as far as you'd like. It won't affect my business over the next five thousand years."

"And you'll give us all this in writing?" Nils still hadn't looked up from his lap.

"I'll see to it immediately." Sadena came brightly to his feet, bringing his hands together with a clap. He held them that way in front of him, as though proud of having snatched something out of the air before the rest of them. "Proctor Tovin, Proctor Oberejen—" He dipped a brisk nod toward the still despondent Nils. "Thank you very much for your services. It's been a pleasure doing business with you."

Rahel waited until the man had left the room before kicking a nearby end table into the closest wall.

Nils jerked his head up with a scowl. "What did you do that for?" The accusation sounded more betrayed than Rahel had expected. "You got what you wanted, didn't you?"

She righted the end table, swallowing a little twist of disappointment when it turned out to be too broken to stand where it belonged. "If you think I got anything out of this safari I wanted," she said as she eased the ruined furniture back down to the floor, "then you don't have the faintest idea what I came here expecting to gain."

Rahel left the hotel that evening by way of the lone service entrance. All three moons dotted a broken line from horizon to apex, and the ever-present rime of clouds stained the sky dull white instead of a more appropriate black or gray. Beach mud

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slipped under her feet, devoid of shells or bones to crunch. A clement breeze from the west lifted her hair away from her eyes, shushing like a maiden aunt who longed to assure her that everything would be all right.

No spybees buzzed for her attention this time, no reporters climbed over each other for a chance to bark their hateful questions. Nils had held court with the netlinks for nearly two hours after leaving Sadena's private chambers. No one stayed on to the end except Keim, a small public access science service, and a token representative from one of the major nets. Natural disasters just weren't news unless people were involved.

Rahel had left before Nils got done explaining that there wasn't even going to be a scandal. She could imagine the disappointment for netlink executives the Galaxy over.

Darkness softened the walk to the Odarkan straits, blurring the landscape, muting the sounds. Even the tongue of rock at the top of the ridge seemed to reach out with no transition between it and the dark water it overhung. Rahel eased herself up to the very thinnest finger of that stone, then used hands and feet to feel her way down to her knees, and finally her stomach, letting her chin hang over the edge so that the view below her stretched on forever, wild and endless.

Water as still as satin, as perfect as black glass. Faintly—first in the deep waters far off to her right, then drifting slowly toward her in swirls of diamond spray—an angel's kiss of light stitched itself beneath the Odarkan's surface. Twinkles of simple jellyfish thoughts passed silently from bell to lash to ruffle. Knowing the patterns for moonlight dancing off the jellies' crystalline cilia didn't soften the throb of wonder Rahel felt at seeing them move.

How long was a year for a jellyfish? Long enough to do everything important in their quiet, jellyfish lives? Long enough that five thousand or five million or five hundred of them would support enough jellyfish memories to take the sting out of dying unfairly? And what if their years left numbered less than five? Was that long enough for anything at all?

"You're better off than we are," she whispered, letting the voiceless wind carry her words to the starlight ripples down below. "We know when your dance is over, but you get to think you live forever."

Right up to the moment when the last glimmer of jellyfish thinking flickered down into the darkness of extinction. ■

The Author would like to thank Chris Laughery of the Pennsylvania Geological Survey and Dr. Karen Rose Cercone of Indiana University of Pennsylvania for their invaluable help with the scuba and geology details for this story. Such willing consultation as theirs gives special life to the science in science fiction.

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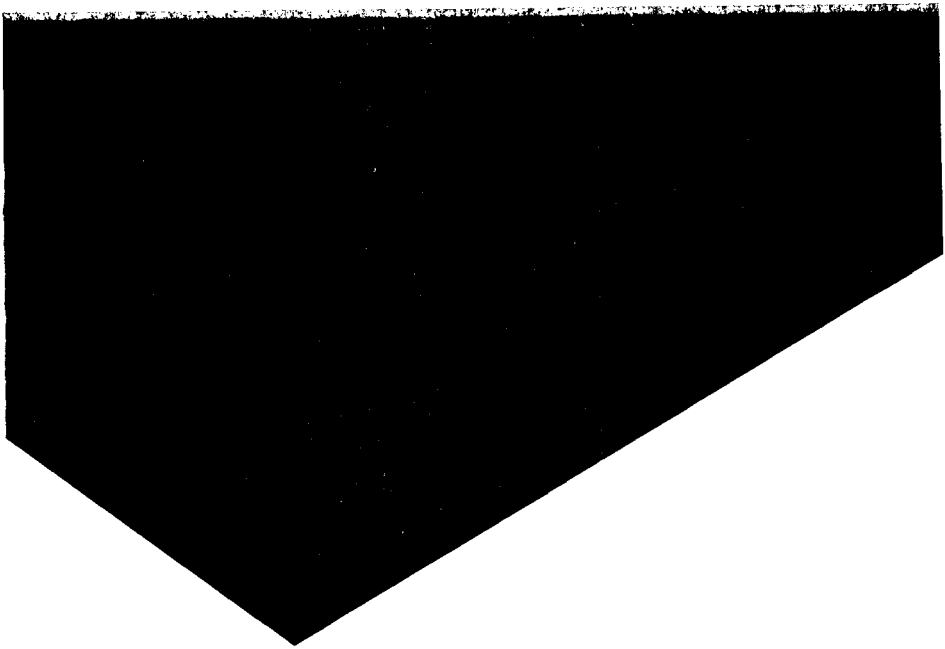

ON THE PLACE OF POETRY IN SCIENCE FICTION

Michael F. Flynn

Has poetry a place in science fiction
Amidst the spaceships and the DNA?
I think it does (at least that's my conviction)
So put your rationality in play.

Measure feet in *meters*. This will give them
A proper scientific ambience.
The beat should have a natural (*loga*) rhythm;
your images, *atomic* resonance.

Above all else, use logic and deduction;
Hypothesize! Experiment, by damn!
You'll find it has an odd sort of seduction;
Your battle cry: "I think, therefore, iamb!"

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Ben Bova

SPACE PROFITS

There is no longer One Place to look for progress into space, but small and potentially important steps are being taken by more private groups than you might have guessed!

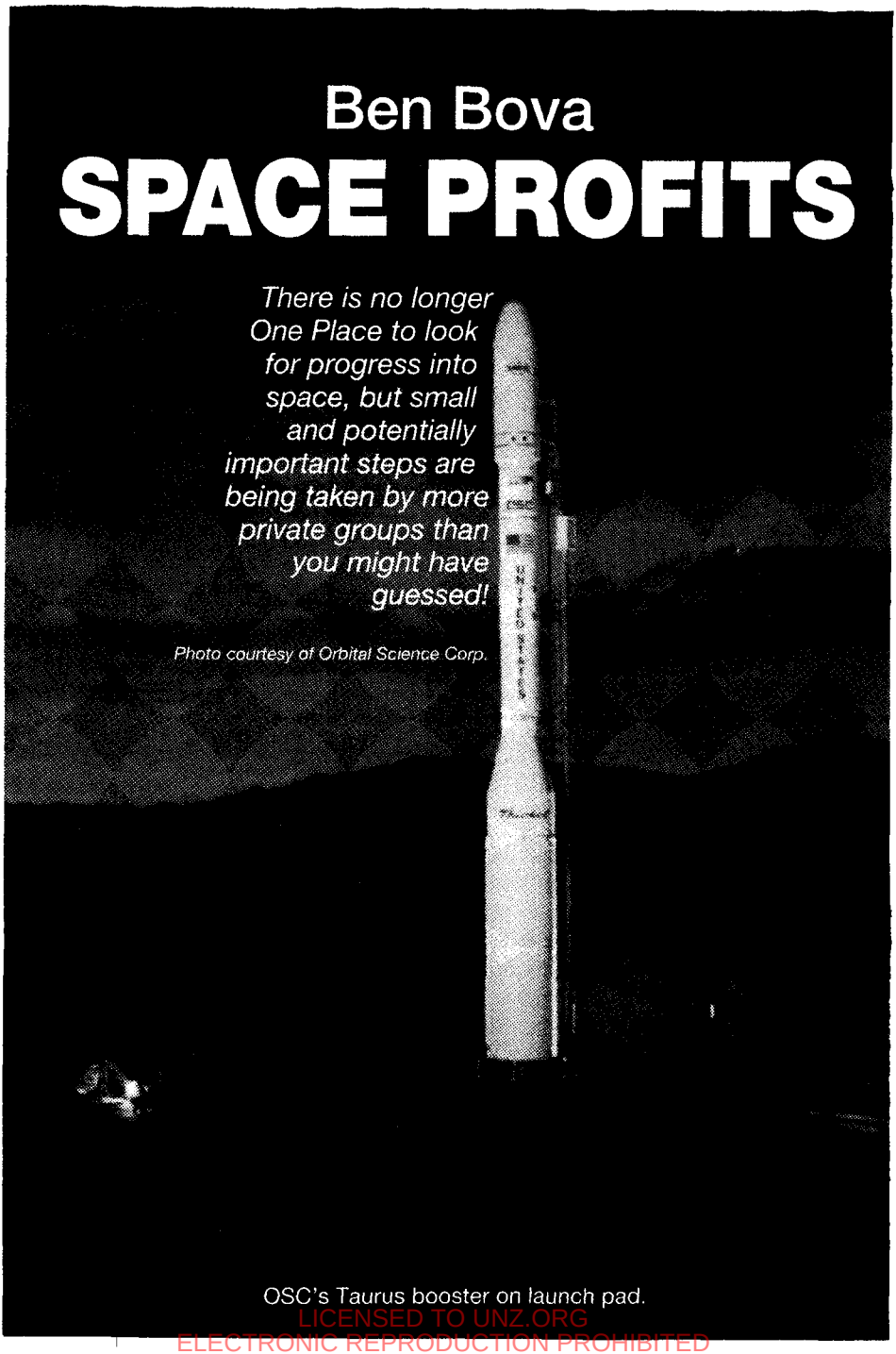

Photo courtesy of Orbital Science Corp.

OSC's Taurus booster on launch pad.

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Remember Delos D. Harriman? In Robert Heinlein's 1950 novelette, "The Man Who Sold the Moon" multimillionaire businessman D. D. Harriman puts the first men on the Moon, completely through private enterprise rather than a government program.

It didn't quite work out that way in real life. Project *Apollo* was run by NASA. It cost $23 billion. It worked brilliantly, putting astronauts on the Moon in less than ten years from a standing start.

But since then, the U. S. Government's space program has been mainly spinning its wheels. No one has gone to the Moon since 1972. The only space station orbiting Earth is the Russian *Mir*. The European Space Agency (ESA), with its *Ariane* booster, leads the world in commercial space launches. China and Japan are already heavily involved in space efforts. India, Brazil and many other nations are moving ahead quickly.

Meanwhile the U. S. civil program, built around NASA, flounders along because there is no powerful political goal to drive a strong government space program. Without a powerful political "driver," such as the race to beat the Russians to the Moon that drove *Apollo*, there cannot be a strong government space program.

Get that straight. Unless and until politicians fear that they could lose their jobs unless we do better in space, the government's space program will produce more paperwork than hardware.

But something else is happening, D. D. Harriman's spirit is alive and well. There is money to be made in space, and private companies large and small are beginning to sniff the sweet aroma of profits.

While the era of private enterprise in space is only just beginning, the lure of profits may well be the major "driver" that will see a powerful new set of space programs—some competing, some cooperating—arise on a global scale.

The first space industry to "go private" was the communications satellite business. Started in the 1960s, commsats now generate more than a billion dollars per year in the U.S., and more billions overseas. Most of the commercial space launches to date have been to place commsats in orbit.

While commsats are still a major customer for launch services, new markets are opening for various kinds of observation and reconnaissance satellites, industrial experiments in low gravity, energy production from space, even space advertising and tourism.

And a hearty competition is already underway to produce a new type of commsat: small, low-orbit relay satellites that will turn cellular telephones into global instruments that can carry voice and data from anywhere on Earth to any other place, any time of the night or day.

Instead of a bureaucratic, plodding government program mired in the political quagmire of Washington, we are seeing the beginnings of a swirling, heady, swiftly changing entrepreneurial challenge that is already reaching across the globe to create new business alliances and competi-

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tions. It's like watching the furry little mammals scampering between the legs of the huge, slow-moving dinosaurs.[1]

Most of these entrepreneurs will go broke. A few will become the Rockefellers and Intels of the 21st century.

For example, consider geographic information systems (GIS), a market that has been estimated at $3 to $5 billion annually, thanks largely to new high-speed systems allowing near real-time processing of satellite remote-sensing data, and the rapidly growing ability to transmit such space imagery to small desktop computers.

Earth Satellite Co.[2], of Rockville, MD, and other firms are selling geographical information, which includes mapping, searching for natural resources, detecting lightning strikes, weather observation, and other surveillance and observation tasks. In the not-too-distant future, satellites will routinely help the media to gather news.

For years the Department of Defense (and, apparently, the Central Intelligence Agency) have resisted allowing commercial enterprises to offer space-based observation systems with resolving powers as good as the military's surveillance satellites. Private companies fought this resistance, pointing out the French *Spot Image* and Russian military reconnaissance systems that Moscow is now offering on the commercial market are already better than anything the Pentagon would allow American companies to put into orbit.

In March 1994 Washington announced that it would grant licenses for commercial sales of satellite imagery able to resolve ground objects as small as one meter across. Score one for private enterprise.

Intergraph Corp., of Huntsville, AL, is already doing about $400 million per year in remote sensing services, and predicting a 20% annual growth rate in GIS-type work.

Environmental Systems Research Institute, Inc., (ESRI) of Redlands, CA, expects to use satellite data to help the McDonald's restaurant chain to determine where to locate fast-food outlets and help plan agricultural strategy keyed to supplying food to those restaurants.

By the end of 1995 as many as one million users globally are expected to be involved in the use of GIS-type data. These new capabilities will be supplied by the French *Spot Image*, The U.S.-based Earth Observation Satellite Co. (Eosat) using *Landsat* data, and future satellite operations, such as Canada's *Radarsat*.

Just as the cable and satellite television has led to "pay-per-view" home services, the satellite remote sensing and GIS sector are beginning to offer similar private access capabilities made possible by the same "information highway" technology.

Thousands of cities and towns around the world are already using

[1] I know that the analogy no longer jibes with paleontologists' view of the dinosaurs, but what the hell.

[2] EarthSat's former president is the well-known science fiction author, Charles Sheffield. He now is a member of the company's board of directors.

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such data. A town in Italy with a population of only 1,200 uses satellite-based GIS data in the town's desktop computer. British researchers use GIS data to pinpoint specific farm fields that could be water-supply pollution risks because barnyard manure has been spread on them.

A key factor in the mushrooming GIS market is the significant reduction in the cost of data processing and software. Systems that a few years ago cost $500,000 can now be purchased for $2,000. This drop in cost, coupled with the new information technology, is creating ever-increasing demand for GIS services.

Digital satellite imagery is even finding uses in legal applications. South Florida Water Management District officials are using *Spot Image* satellite data—which can resolve features as small as a fortieth of an acre—to identify land-use volations in their 16,641-square-mile jurisdiction. In a recent case involving illegal drainage of a wetlands area, comprehensively documented by satellite, the defendant repaired the environmental damage and paid a $650,000 fine. Comparable helicopter and ground-based surveillance would be too costly and time-consuming for the agency to use effectively.

Private enterprise sometimes results in strange bedfellows. Sea Launch Investors, headed by the retired former chairman of the U. S. Joint Chiefs of Staff, Admiral Thomas H. Moorer, is working with the retired former head of the Russian navy to convert 200 or more submarine-launched ballistic missiles into space boosters.

Sea Launch Investors is looking at the SS-N-23 *Shtil* missiles for suborbital microgravity missions and other uses. The *Shtil-3* could place a 1,470-pound payload into a 124-mile orbit, or put 900 pounds into a 495-mile orbit.

More about Russian boosters later.

While some of the major aerospace corporations, such as Lockheed, McDonnell Douglas and Martin Marietta are becoming heavily involved in commercial space operations, new companies such as Orbital Sciences Corp., EER Systems and Amroc are carving their own niches in space industries.

Orbital Sciences Corp. (OSC) is perhaps the leader among these new companies devoted to space technologies. OSC developed the *Pegasus* booster, a winged rocket that is launched from a converted jet airliner. It has also produced the Transfer Orbital Stage (TOS), an upper-stage rocket system that successfully propelled NASA's *Mars Observer* spacecraft toward its ill-starred rendezvous with the red planet, and the medium-sized *Taurus* booster.

OSC is marketing space flight services for small science missions using an ultralight, low-cost satellite "bus" developed for the company's own commsat network. The MicroLab Orbital Experiments Service will offer frequent flight opportunities to experimenters for a fixed price of less than $10 million. The 100-pound satellites will be launched by *Pegasus*.

This service offers university and laboratory researchers a "turnkey"

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operation where the customer provides the instruments, sensors or other small payloads that OSC integrates with its satellite "bus," and then launches, operates, and collects data for 12 to 24 months. Typically a mission would be launched within a year of contract signing.

In contrast to the gigantic projects and decades-long time frames of NASA and other nations' space programs, OSC has pioneered the "small is beautiful" concept in spacecraft and launchers, concentrating on systems that can be designed, built, tested and put into operation in a matter of a few years, at most.

OSC is the major player in ORBCOMM, a global communications network based on small, low-altitude satellites. Here the competition is strong. Motorola is leading a competing international consortium in the *Iridium* program, which is aimed at global cellular phone service. The first *Iridium* launches are scheduled for 1995.

And OSC is in the observation and surveillance business, too, with its subsidiary Orbital Imaging Corp. Under contract from NASA's Marshall Space Flight Center, Orbital Imaging will provide atmospheric research data from its first MicroLab satellite. MicroLab I will detect lightning strikes worldwide, part of an effort to help understand and predict major storms. The satellite will also carry additional experiments related to atmospheric effects on the radio signals from the Global Position System (GPS) network.

One of the long-term dreams of space pioneers, such as G. Harry Stine, has been to use the microgravity environment and free solar energy of space to develop orbital manufacturing industries. Researchers at several universities and corporations are taking the first steps in that direction.

While materials-processing experiments have been carried out on the space shuttle and the *Mir* space station, such government facilities are too expensive, and their waiting lists too long, for most researchers. Low-cost boosters that can be available quickly, such as those developed by OSC and other launch-services companies, are the key to opening up the orbital manufacturing frontier.

Pharmaceutical products, crystals of various kinds, and even cast iron smelting are being investigated. Biocryst, a new company spun off from the University of Alabama in Birmingham, is studying the biomedical applications of microgravity research.

What about tourism in space? In 1983, a Seattle-based company—Space Travel, Inc.—announced it would build a passenger compartment that would fit into the space shuttle cargo bay and take paying tourists for rides in orbit. That goal proved impossible, mainly for safety reasons; the passengers would not be able to get out of the sealed compartment in an emergency.

In 1986 the company moved from Seattle to Washington, DC, changed its name to Spacehab, Inc., and hired former NASA administrator James Beggs to be its chairman. Spacehab now builds a pressurized experiment module—"a sort of walk-in closet in

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space"—that flies in the shuttle's cargo bay and contains 50-some lockers that can be rented by experimenters for $1.8 million per flight.

Although no commercial customers have yet been attracted to Spacehab's offer to fly small experiments aboard the shuttle, NASA itself has become a major customer and has fully booked the Spacehab module for two shuttle flights, and reserved half the module for two more missions.

Will tourists fly in space? Eventually, but Spacehab has put that dream on its back burner in the foreseeable future.

One dream that is very much alive—in Japan—is the concept of the Solar Power Satellite. Invented in 1968 by Dr. Peter Glaser of Arthur D. Little, Inc., SPS has been studied by NASA and the Department of Energy, and quietly buried in a mountainous pile of reports.

Not so in Japan. In February 1993 Japan's Institute of Space and Astronautical Science conducted the first experiment in space in which microwave power was beamed from one spacecraft to another. The power level was only 900 watts and the experiment took less than a minute.

But that was the first step in Japan's Sunsat program, which includes a project called SPS 2000, aimed at building an experimental Solar Power Satellite capable of delivering 10 megawatts of electrical power to the ground.

The global electrical power market will exceed one trillion dollars per year early in the next century. Whoever can supply a significant portion of that energy from space stands a good chance of attaining enormous wealth—and political clout. In Japan, where private corporations and the national government are intimately intertwined, the Sunsat program is part of a carefully-planned long-range program to achieve the kind of energy independence that the U.S. government has talked about from time to time, but done nothing to achieve.

All of these hopes and plans are critically dependent on the cost of getting payloads into orbit. If the space frontier is going to blossom, it will require better, cheaper, and more reliable access to orbit than we now have.

Private companies are pushing hard in this crucial area of launch services. While the federal government lurches along with studies and investigations and start-and-stop programs such as the National Aerospace Plane (NASP), a study program called Spacelifter that never got off the ground (literally and figuratively), and improvements of the space shuttle, other possibilities are beginning to open up.

Readers of this magazine are familiar with McDonnell Douglas's *Delta Clipper* program. Single stage to orbit. Fully reusable. Operated like a commercial airliner, with quick turnaround time and small ground crew.

Started under funding from the Strategic Defense Initiative and now supported somewhat reluctantly by NASA, the one-third-scale DC-X has performed so well in its initial tests that optimists see the chance for ma-

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jor reductions in the cost of putting payloads in orbit.

If the Delta Clipper works, flights to space may become as commonplace as commercial airline flights, and as inexpensive as a round-the-world cruise.

In the meantime, American companies find themselves locked in a global competition with the government-subsidized launch services of Russia, China, and other nations.

Yet capitalism has a strange way of making partners out of competitors. Lockheed, for example, is marketing Russian Proton boosters for heavy-lift missions—as well as designing and building its own fleet of small- and medium-sized boosters for the commercial market.

The Russian *Energiya* is today's heavyweight champ among rocket boosters, with a lift capability similar to the *Saturn V*. There are no commercial applications in sight for *Energiya*—yet. But if and when Japan begins to build its first Solar Power Satellite, the launches may well take place at Tyuratam.

From OSC's *Pegasus* to Russia's *Energiya,* space entrepreneurs now have a broad range of rocket boosters available for payloads of any size. When and if the *Delta Clipper* starts flying into orbit, the costs of working in space should come down dramatically, and the profits go up.

There will be rivalries and competitions, among private firms and between nations. A few years ago the U.S. formally complained that China was subsidizing the launch costs of its *Long March* booster so heavily that they were competing unfairly, marketing the *Long March* at artificially low prices to keep American and other competitors out of the game.

There will be combinations and cooperation, as between the two admirals who once maneuvered nuclear submarines against each other but now are converting their ballistic-missile swords into commercial boosters. Motorola's *Iridium* program includes partners from Europe and Asia, as well as several other American firms.

None of these efforts, however, involve people in space. With the sole exception of the somewhat distant dream of space tourism, all these private entrepreneurial efforts are based completely on unmanned missions.

Yet that will change. Inevitably.

Let me paint a picture of how future space operations will probably evolve, with a strong accent on the word *probably*.

Government space efforts will continue to focus on those things that governments do best: military space missions, for example. The military uses satellites for communications, weather observation, and surveillance. As more and more nations acquire the capability of building ballistic missiles (the dark side of their commercial space endeavors), some version of a Strategic Defense Initiative-type space-based defense system will be built, sooner or later.

Governments will also support—haltingly, grudgingly—the continuing scientific exploration of space. Not even the most calloused politician can completely ignore the scien-

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tific community. We will explore Mars, with robots at first, but ultimately with humans.

Which means that government space programs will continue to support human space flight. The long-delayed U.S. space station is now a cooperative venture with the Russians, considered by many foreign-relations experts in Washington a centerpiece of the Clinton Administration's attempt to make our one-time enemy a close and cooperative friend.

Astronauts and cosmonauts will work together in orbit, and build the foundations for the lab technicians, factory workers and mining prospectors to follow.

In the private sector, some companies are going to become incredibly profitable by selling launch services, communications, geographic information, spacecraft, industrial processing, and space-based solar energy.

These private commercial efforts will not involve humans in space, at first. But as their operations in orbit become more and more complex, private firms will begin to send human repair and maintenance people into space. And then construction teams and factory operators. And then teams to the Moon, to develop lunar resources for supplying their facilities in Earth orbit.

A wave of greedy capitalists from many nations is going to spread across the Solar System, busily looking for new ways to make profits, while government officials and lawyers try to write regulations and laws to keep them under some semblance of control.

The frontier is there, and we are already beginning to develop it. The first steps are small and hesitant, but they have at last begun. ■

Deliberation: the act of examining one's bread to determine which side it is buttered on.

—Ambrose Bierce

We know Mars can support life. If microbes couldn't do it, we probably can.

—Robert Zubrin

(Submitted by Marianne Dyson)

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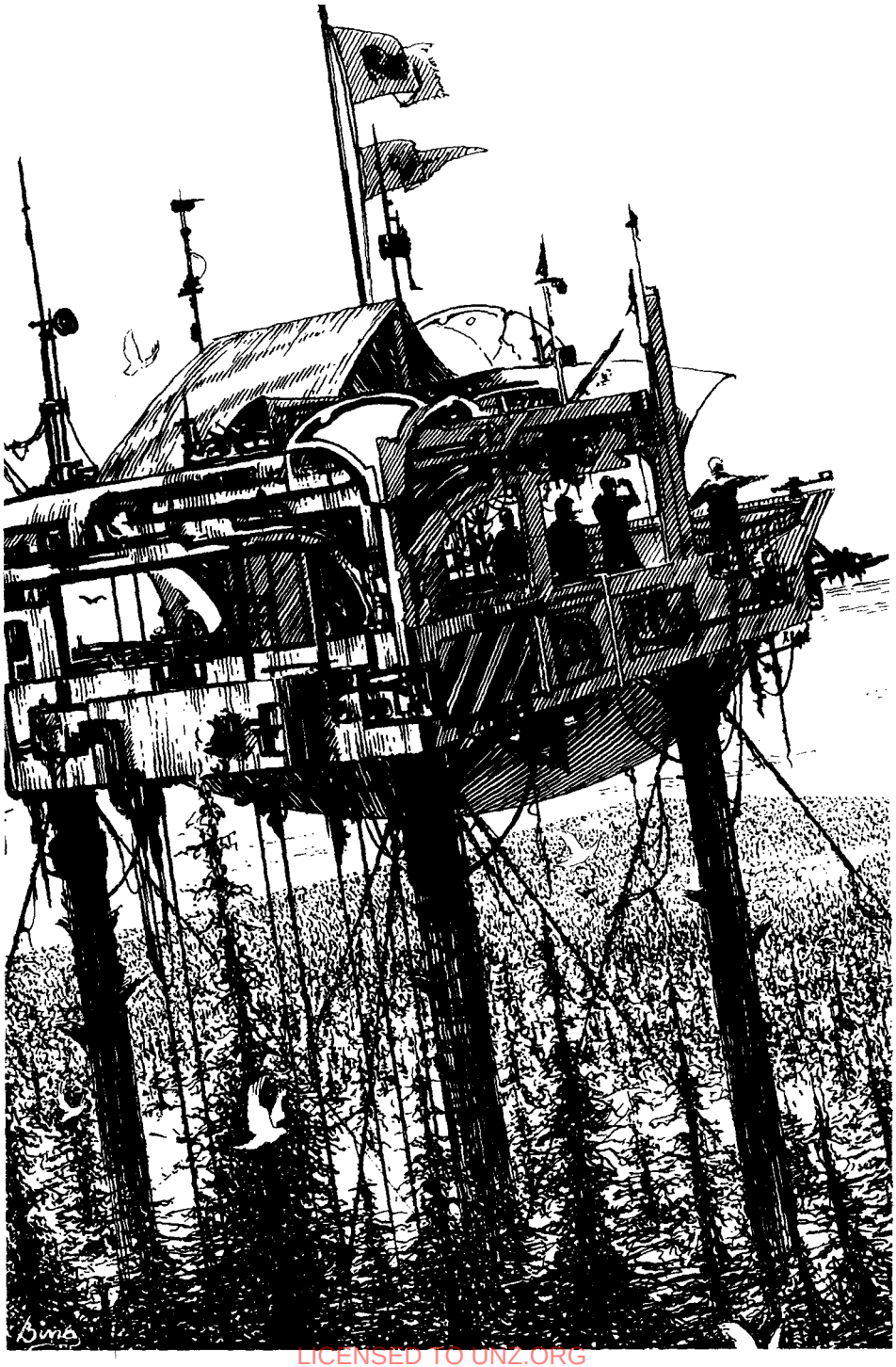

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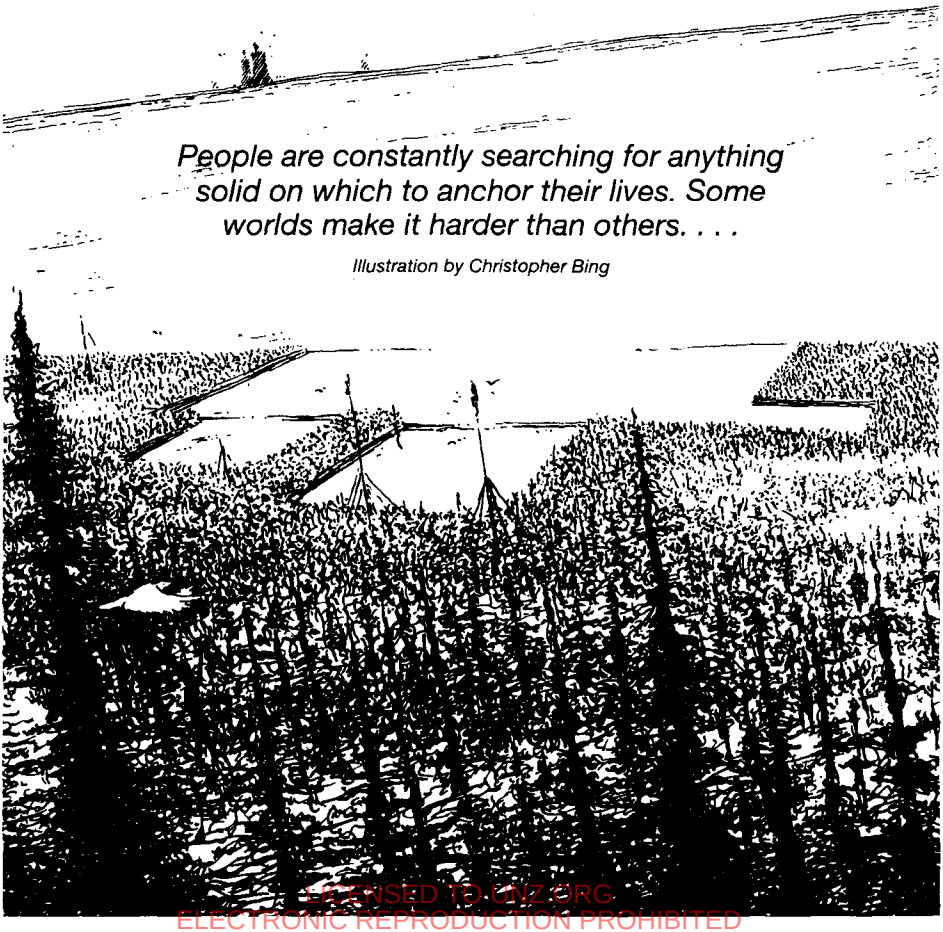
Daniel Hatch

IN FORESTS AFLOAT UPON THE SEA

People are constantly searching for anything solid on which to anchor their lives. Some worlds make it harder than others. . . .

Illustration by Christopher Bing



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ONE

Why are we here?
—Aidan O'Hara, founder of the Determinist Pastorate, Year 82 A.F. (After the Fall)

Where are we?
—*Unknown navigator, Year 0* A.F.

The ship arrived when Telly McMahon was two watch-years shy of his first side-year, late in adolescence when all things commonplace had created for him an oppressive prison.

Fortune, or fate, put him in the chart house when it first was sighted—the one place on Schenker Float where Telly felt free from the bonds of mundane life.

Duncan Blake was holding his class in celestial navigation. They had just completed taking the afternoon sighting of the Furnace, still a good thirty degrees shy of the zenith.

"Everyone still has their whiteboards and charcoal?" Blake asked, looking up from his charts and almanacs briefly with narrowed eyes. "Now I want you all to calculate the afternoon position. Work separately, no comparing notes until you're done. And God's Plan, McMahon, don't you dare blurt out the answer before the rest of them are finished."

Telly felt his face burn, but then saw the smile under Blake's grey beard. They both knew he was the navigator's best student.

Telly worked out the solution quickly. He was a master with the circular slide rule, and calculating positions was child's play. The hard part was getting a good sextant reading when the horizon was lost in the haze and the Furnace was a tiny dot masked by the instrument's thick screens.

While the others pored over their boards, scribbling with the charcoal, his gaze drifted towards the business end of the chart house.

The station's three chronographs hung on the wall above the plotting table, mounted in a wooden frame with the two smaller clocks to mark the twenty-four-hour watch-day that tied them to old Earth flanking the oversized monster in the middle, which measured out the long sidereal day of Okeanos every seventy-six hours and forty-eight minutes.

Telly's eyes lingered over the intricate markings on the big clock, but it was the plotting table that captured his imagination. It was there that the North Einstein Gyre lay before him in all its vast emptiness.

The currents were indicated with pale blue ink and labeled with a flowing hand, from the West Wind Drift in the north to the equatorials in the south, and from the Chandler Current in the west to the Webster in the east. And the long track of Schenker Float was marked in red with dates cribbed in cramped script alongside triangular plots.

For nearly three hundred watch-days they'd drifted slowly to the west along the North Equatorial Current—nearly a hundred side-days. Now they were heading into The Queue, the broad swirl of waters where the Equatorial Current merged with the Chandler Drift. In a few weeks, they'd be caught up in the

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Chandler and swept away to the north side of the gyre once again.

The anchorages were marked on the chart with green ink and outlined with blue. Bishop, Ellsworth, the Colts, Atwater, and the Vintons—the few fixed points in the endless swirl of air and water. He could almost imagine them in miniature in the virtual ocean beneath the glass—their long anchor chains taut against the pull of the sea floor and the press of current and wind.

Lacking from the chart, however, was the most flagrant feature of the Einstein Ocean and the Hawking and the Newton—of all Okeanos. There were no markings for the floats themselves, the thousands of masses of stone and salt and ferns and trees that gave the gyre its body and soul. There could be no markings for the floats, of course, any more than there were any for the winds.

Telly shot a guilty glance at one corner of the chart, however, where a much younger navigation student left alone in the chart house had tried to make such marks. A dozen pale green dots, as ghostly as the positions they marked, one for every square degree, had been inked at random intervals in a five-degree box in some part of the ocean that Telly hoped the Schenker would never come near. They'd made it easier for him to imagine what he could not see.

He looked up at the sound of an almanac slapping shut, its oilskin cover flopping loosely against the table. Blake was finished with his own calculations. Schenker's chief navigator was beginning to show his age. He was more than fifty watch-years on his journey and a veteran of the Pirate Wars as well, but his eyes still burned with a youthful fire. At the moment, they burned for Telly, as Blake saw that he had long since worked out the equations that told them their position.

He waited a while before prodding the rest of the class into finishing their work. Telly looked them over himself. Ivan Hayes was a big boy with clumsy fingers. He had smeared charcoal all over his fleshy face, but he looked satisfied with himself. Eppie Borges also looked pleased with her results and tapped a foot impatiently while the others caught up.

"I swear, Telly McMahon, if God has a plan, it's to make a navigator out of you," Blake said softly.

"Telly doesn't believe in God's Plan," said Eppie, a devilish look in her blue eyes. Telly shot her a stern glance, but it had little effect. She could get away with such heresy because she was not a Determinist herself, but came from the Skeptic village on the starboard quarter of Schenker. "He won't admit it out loud, but I know," she added.

Telly wanted to do something to make her take back her words, true as they were. But he knew better than to try something like that while in class.

"All right students, settle down," Blake said, waving his whiteboard. "Everyone done? Very well, did you all come up with at least 14 degrees north latitude and 16 degrees west longitude? Good. That means you're within 70 nautical miles of being

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right. Let's see how close you were."

He went through the nine student navigators one by one, saving Telly for last. "Well McMahon, you came within a half mile of my position. Pretty good for the day."

"I had trouble getting a clear shot at the horizon," Telly said.

"No you didn't," Blake told him. "I did. Given a choice, I'd take your numbers. But don't let that give you a swelled head."

Telly held back a smile, afraid that it would only give the others a reason to taunt him. And he was getting too old to be able to deal with that the way he once did—by wrestling the taunters to the ground and forcing them to take back their words.

"Now the rest of you, where did you go wrong? How many had problems with calculations? How many with observations?"

They raised their hands dutifully at each question, but before Blake could continue, the enunciator tube at the front of the room whistled softly. He hurried over to the tube with surprisingly sudden grace.

"Halloo above," he said.

"Halloo below," came the miniature voice of the student on watch up on the bridge. "Ship ahoy, due south, two-masted schooner."

Everyone in the chart house drew in a breath at once. They all knew what a ship meant these days. While in Blake's youth, it had meant the threat of battle and pain, now it meant the likelihood of celebration.

Their eyes lit up, and they chattered with excitement until Blake cast a surly eye at them. Even Telly could feel his heart beat faster.

But he had a private reason to celebrate the arrival of a ship. This close to the Queue, there was a good chance that it came from Bishop Anchorage. There was a navigation school at Bishop—and the promise of liberation from his lifelong captivity aboard Schenker Float.

Blake was clearly concerned with more immediate problems.

"All right, let's get organized. Miriam, light off down the path and find Pastor Kline, let him know there's a ship coming. Telly and Eppie, you're coming up to the bridge with me. Ivan, you stay down here and man the plotting board—you're quick enough to help up topside, but you're just too big to take up in the hoist with the rest of us."

Ivan frowned, but it wasn't serious. Telly knew he was nervous atop the bridge and was just as happy to remain below.

The navigator collected his equipment—a whiteboard, his own sextant, a battle-scarred long glass from the Pirate Wars—and whistled up to the bridge. "Three on the hoist," he reported.

They entered the cramped box while the watchstander shifted ballast weights up above. A moment later, Blake and Telly began cranking the windlass.

It was a difficult and sweaty job to get them up the tall tower to the bridge—even with the counterweights taking off most of the load. When they reached the top, Blake opened the hoist door, and they all

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spilled out onto the bridge wing. Telly felt quick relief as the wind hit him square on—here on the North Equatorial the trades blew unceasingly, pushing the waters and the floats along day after long day.

He looked over the rail briefly at the forest floor seventy meters below. It made him feel more than a little dizzy, so he shifted his attention to the tops of the steelwoods and mast trees that danced in the breeze only a few meters beneath the bridge.

Schenker Float was almost ten kilometers across, but from up here, it looked so small—and to Telly almost as confining as it felt. Down there were all the boringly familiar landmarks of his life. The hog farm spread off to the east—a barren patch in the otherwise rich greenery of the float where the poisons from the livestock dissolved the native vegetation. Villages were barely visible through the woods on the float's port side. The Great Lagoon to the south and the smaller lagoons around the compass seemed to glow with a turquoise light.

The paths connecting them were more than tracks through the trees, they were lines burned into Telly's mind and impressed onto his memory. Their unchanging constancy, like everything else about Schenker, formed the chains that bound him to its ground.

But from up here, Telly could also see all that made him feel free and alive—the sea and the sky. The endless sea that wrapped Okeanos with waves without end was dotted with countless bergs—some large enough to sprout spar trees and yardwoods. To Telly, they looked like dozens of miniature floats—the ocean made small enough to see all Schenker's distant neighbors at once.

And the sky was filled with countless fluffy white clouds, chains and columns, trailing off upwind and downwind, making barricades around the horizon. Gray clouds were piling up on the southwest side of the float, trailing gauzy rain across Fishing Village. To the southeast the bright white dot of the Furnace burned painfully bright in a deep azure sky.

Also to the south, near the horizon, Telly saw the sparkling white triangles of a ship's sails emerging from the distant haze.

"Eppie, you uncover the heliograph," Blake said. "They'll be in range in a little while. Telly, I want you to help me track them. Maybe we can even get some good triangulation bearings to figure their distance."

Telly's moment of inspiration at the grand view of the world was swept away by the needs of the moment. He went to one end of the bridge and unlimbered the peloris while Blake did the same at the other end.

It took them several minutes to get bearings that were accurate enough to calculate the distance—more than eleven miles.

"If you were sailing master, how would you approach us?" Blake asked as they put their heads together over the whiteboard.

Telly looked upwind, then off to the south. "I guess I'd have to come

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up on the west side of the float and tack in from the northwest to get to the docks."

"Good guess," Blake said. "How long do you think it'll take them?"

Telly shrugged. "I don't know. I'd need a plotting board to work it out."

"You shouldn't. Not if you know your sailing. I give them four hours if they've got a clean hull."

"I'm ready with the heliograph," Eppie called.

Blake hustled down the platform to where she stood next to the vaned shutters. Telly put his eye to the peloris to get a better view of the sailing vessel. It had two masts and three sails—two big ones on the masts and a jib rigged out front. It had to be more than thirty meters long.

"Go ahead," Blake said. Eppie slapped the shutters open and shut rapidly three times, waited, then repeated the signal. A minute later she did it again. A third try produced a response—three flashes from the main deck of the schooner.

"All right!" Eppie shouted.

"Send this message," Blake ordered. "Welcome to Schenker Float. Mooring and docks bearing 330 true from here."

The shutters clapped quickly. Eppie was good at working the heliograph, even better than he was.

A couple minutes after she'd finished the message the reply began to flash across the sea. Telly started reading the code, but had trouble keeping track as Blake spoke it aloud. "Ahoy ... Schenker ... Hospital ... Ship ... Relief ... Nine ... Days ... Out ... Of ... Bishop ... Anchorage ... break."

Telly's heart leapt skywards at the news. Bishop Anchorage. Sacred words that were inscribed in the navigation manuals and almanacs in the chart house below. Words he had memorized as a child, when he first had dreamed of fixing the position of the float against the sea and stars. "Published by the Navigation School, Bishop Anchorage."

From that moment on, as far as Telly was concerned, no one afloat on Okeanos was as important as a navigator. They were the link between the inhabitants of thousands of isolated floats. Fishermen could not venture beyond sight of home, merchants could not trade, pastors could not communicate, and physicians could not visit the sick and injured without a navigator to find the way.

Long before his first lessons with Duncan Blake, Telly had imagined himself a student in the school at Bishop Anchorage, learning the secrets of the craft. Before he knew what the calling involved—long weeks at sea far from anchorages or floats, through fair weather and foul, in crowded quarters aboard leaking ships. But as he grew and learned, the burdens never seemed to outweigh the romance.

Graduates from a navigation school could write their own tickets. You could work your way around the world, sailing from anchorage to anchorage on a merchant ship or man-of-war. Blake had studied in the school at Crawford Anchorage in the South Einstein, but Telly had always set his sights on Bishop—for no other

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reason than that it was known to him.

Now it was less than nine days' sail away.

And it might as well have been on the other side of the world, he realized suddenly. His heart dropped like a wounded bird as he thought of what he would have to do next.

There was no chance he could leave for Bishop Anchorage without the permission of his parents. He wasn't of age yet—and when he would be, in two more watch-years, Bishop would be far behind them.

But the thought of asking his mother if he could leave Schenker Float for the wider world made him shiver. His hopes fluttered, dying on the wind while barely out of the nest.

They tracked the ship for two hours, watching it make its way along the course Blake had described. It worked its way up the west side of the float until it was a few points north of due west, then it came about and headed straight back towards them on its southeasterly tack.

"Meet me at the docks when she comes in," Blake said when Telly made his leave. "I'll get you aboard her."

Telly's chest filled with excitement. He hadn't expected that. When the last ship that had come by—a merchantman from the Colts several weeks back—he'd been lucky to get away from duties and classes long enough to look at it from the pier. But that was before he'd moved up to Blake's class section.

"Yes, sir," he said.

Blake gave him a salute, and Telly, filled with pride, returned it. Then he climbed into the hoist and released the brakelatch. Just before it began to drop, Eppie swung around the frame at its top and climbed in. Telly was about to scold her for throwing off the balance, but she smiled and said: "I just whistled down to Ivan, and he's hooking the stone on now."

"I hope it's not his," Telly said. "I don't want to have to pull us all the way down."

"Just keep your foot on the brake and your hand on the windlass," she said. "Or would you rather I handled it myself?"

"Damned Skeptic women," Blake said with a wink. "They never give a man a chance."

Telly agreed, but didn't dare say anything. At least not until they were back on the ground. He just let the hoist drop below the deck of the bridge in sullen silence.

"I know what you're hoping," Eppie said before they descended more than a couple of meters. "You want to take that ship back to Bishop Anchorage and go to the Navigation School."

Telly snarled something unintelligible and looked out through the heavy timbers that supported the bridge, trying to spot the schooner to the west.

"You can ignore me if you like, Telemachus McMahon, but I know the truth. You told Ivan, and Ivan told Helen, and Helen told me. But you're afraid because you don't think it's God's Plan."

"Don't be so sure of what people tell you," Telly said.

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"It's true, isn't it?"

Telly looked her in the eye, and instead of a callow, taunting girl, he saw a sympathetic soul. He realized that she wasn't trying to tease him, but was genuinely concerned about his feelings. For a moment, he almost wished she was just the callow girl, but then he relented.

"Some of it," he said. "But I don't just think it isn't God's Plan. I know it isn't."

"And how do you know? Did God tell you?"

"No, He didn't. And that's how I know. Only I don't even believe in that stuff, so I don't know what difference it makes."

"If you don't believe in it, then why did you say I was lying earlier?"

"I didn't say you were lying," Telly replied. "I said you didn't know what you were talking about. And you don't."

"Then tell me—do you believe or don't you?"

"You want the honest truth?"

"Yes."

"I guess I don't. Because if I did, then I'd have to follow God's Plan. And from what my mother says, that means staying right here on Schenker Float the rest of my life and doing the same thing people have been doing here for four side-years—having babies, working, getting old, and dying."

Eppie frowned, letting her sympathy wash over him. She reached out and stroked his cheek with the back of her hand. "There's nothing wrong with having babies," she said.

"I guess not, but there's something wrong with staying here if what you really want to do is be a navigator."

"You can be a navigator without leaving Schenker Float," she said. "Duncan Blake has been the navigator here for as long as I've been alive. Longer."

"But that's not the kind of navigator I want to be," Telly said, a slight whine creeping into his voice. "I want to sail ships. I want to get loose from here and travel the great wide ocean. I want to leave Schenker Float forever."

Now Eppie looked sad, not for him, it seemed, but for some other reason. As if what he wanted made a difference to her. Telly couldn't figure it out, but then he never had been able to understand much of what girls said and did.

"You know what I think? I think you're afraid of what your mother believes is God's Plan. And if she doesn't think it means you should be a navigator, she won't let you go."

Telly sighed. "It's more than that," he said.

"More? Like what?"

"More than I can explain to you," he said. He knew he was not just trying to avoid her questions. How could he explain his mother and her moods. She was one of those people who followed the rhythms of the Furnace—up for more than thirty hours when it was daylight and down for as many hours when side-night fell. And her moods matched the sky—bright as the Furnace and dark as the night.

That seemed to silence Eppie for a moment. Then she set her shoulders forward and forced out her breath. "You Determinists are all too compli-

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cated for me. You should have been born a Skeptic. You spend all your time trying to figure out God's Plan, except there isn't any plan. You should just live your life the way you have to, do what's right, and never think twice about what it means. Simple as that."

"That's easy for you to say," Telly said.

"Why is it any easier for me to say than you?" she asked.

"Because your mother isn't a believer," he replied.

And with that, the hoist hit the bottom of its track, Telly opened the door, and they both climbed out.

TWO

Why did Noah bring piglets along on the arks after the Fall? So people wouldn't have to eat their dogs.

—Old children's game
from 1st Century A.F.

A pack of small dogs raced out from under the shade of the central storehouse to greet Telly when he entered the rational. They were family dogs, some belonged to his cousins, some to the neighbors, and two were his.

Smokey was a short-haired black mix between a cocker spaniel and a beagle. He thought he was lead dog in the pack, but there were others that disputed that status. He'd been Telly's for five watch-years now. He gained some distance on the rest of the pack to reach Telly first.

Close behind him was Harry, a black-and-tan terrier. Harry had no doubts about his status—he was bottom dog, with no aspirations to leadership. He was barely done being a puppy, but he was smart—a natural-born thief that stole food at every opportunity.

They circled him closely, leaped up to greet him, and barked and barked and barked.

Telly watched them bemusedly. They were so natural, never giving any indication that the absurdity of their situation—eternally afloat on a vast world-girdling ocean thousands of trillions of miles away from the world for which they were meant—made any difference for them. As long as they could run free and chase phibs, they were happy. None of them cared a bit for God's Plan, Navigation School, or life beyond the limits of Schenker Float.

As if to prove the point, once they were done with their greeting, the dogs went back to their own peculiar social interactions, sniffing, pushing, and scolding one another, as they returned to the cool shade beneath the store house.

In the three side-years since the first Determinists came to Schenker Float, their numbers had tripled and their villages had spread across much of its available ground. Of the more than thirty big pontoons that made up the float, more than half were too young to be used for much more than hunting and fishing. The villages were clustered in the oldest pontoons where the ground was high, the trees tall, and ponds of fresh water had collected over the years.

Workshop Village was only a short distance from the chart house—and the geographic center of the float. It

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comprised more than two dozen rationals, more than a thousand souls.

Telly's rational sat near the edge of one the freshwater ponds within a two hundred-meter circle scattered through a stand of blackwood. The trunks of the trees were wrapped with orchid vines planted long ago by the float's first families.

There were eight households bound together in the basic rationing unit of Okeanos, formed long ago when scarcity demanded a stricter accounting of ham, charcoal, and salt.

One household was quiet and dark—home to three women and two men who had passed on into their fourth side-year. Two of them were Schenker's original settlers.

Two households shook with the screams and squawls of young families, with kids barely weaned and dressed.

Four of them bustled with mature broods: one or two grandparents, their children, and their grandchildren, all packed together under one roof, and nearly bristling with domestic tension. Two of the latter included his aunts, both his mother's sisters.

And Telly's own household consisted of himself, his parents, and his older brother—though Larry spent much of his time at the corral with the other Downies.

Aunt Cassie and Aunt Nickie were at the storehouse, breaking out charcoal, grain, and salt pork for tonight's supper.

Telly's home consisted of a raised platform a meter and a half off the ground, wrapped with braided wax wood, sporting woven sail-leaf shutters and a roof of blackwood shingles.

"Your mother's not here yet," Aunt Cassie called to Telly as he started for his front steps. "It's her turn down at the corral."

Cassie was the younger of his two aunts. Telly had never felt much affection for them—he heard their nasty remarks about his mother when they thought no one else was listening. They carried the tone of mocking sympathy, but always laced with a sense of smug superiority.

"I know she can't help it, but I would never talk to my husband the way she talks to Pat," Cassie would say.

"I don't know why Mother always favored her," Nickie would add. "It didn't do any good in the end. And if I couldn't control my moods, I'd at least keep them to myself."

Years of that had taught Telly never to trust his aunts and to keep a healthy distance from them. He wondered sometimes what they must say about him. "He's got his mother's attitude, you know. He never gets close to anyone."

Telly was worried that he'd missed his mother now. She'd be working with the Downies until supper time, and that was when the ship was due to dock. He'd hoped to find her home.

He knew of only a few times during each side-day that he could approach her and get a reasonable response. She was best in the hours after sunrise. But the Furnace had been up since the middle of the mid-watch—more than twelve hours now—and his chances were getting slim.

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By the time it made its seventy-six-hour circuit back to dawn, the ship might be gone. His heart sank at that thought.

His only other chance might be shortly after sunset. If he could catch her before her mood slipped from its daylight high to its dark night's depression, he might have a chance of talking her into it. But only a slim chance. It was hard to predict her moods at night. Sometimes she would wind down slowly, other times she would crash precipitously. It made living with her difficult—and at times impossible.

He waved at his aunts, then turned away from the house. It would be best if he waited until later. First there was the strange and wonderful ship itself to see. He headed up the path through the center of the village towards the boatyard on Landfall Bay.

Telly hurried through the thick grove of polymer trees and covered his face with one hand as he did. The boles of the trees oozed thick liquid from countless taps into a network of lines and buckets. At the same time, they released hideous vapors into the air that collected at the back of Telly's throat and threatened to make him gag.

His ordeal was brief, however, as he passed quickly into the boatyard.

Steam, sawdust, noxious fumes, and noise all spilled out of the workshops in equal measure as Telly made his way towards the waterfront.

The worst of the fumes came from the plastic works, where the gluepots extracted resins from the polymer trees to make polyesters, nylon, and the rest of their strange menagerie of materials. But the loudest noise came from the sawmills, where fallen trees were transformed into beams, posts, planks, shims, dowels, and all the rest.

The yard sat on the inboard shore of the bay on the forward side of Schenker float. The boundary between a young pontoon full of lush undergrowth sprouting from pumice and rootbind and the older pontoons of the float's ancient core, split it down the middle. Worksheds filled the woods inboard, while hulls, masts, docks, and ways littered the outboard flats. Work crews caulked the seams of a single hull, a twenty-meter ketch with two masts, sitting in the ways, and sealed the wood with plastic.

When Telly reached the waterfront, the sails of the visitor from Bishop Anchorage were billowing with the wind.

The ship was a two-topsail schooner, and as she breached the mouth of the lagoon and came about, all her bright linen caught the northeast wind. Big gaff sails pulled on the masts, with double topsails and topgallant sails above—and a big red cross was emblazoned across each topsail. Four jibs helped bring the bow around smartly as she switched tacks.

As they approached the middle of the bay, the ship's crew reefed in the topsails and drew down two of the jibs. The foresail came down next, the ship slowing as it made its final tack and steadied up on a course straight towards the shore.

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"A fine ship. She handles like one of your father's crankboxes."

Telly looked over his shoulder to see Duncan Blake standing behind him, watching the ship make its final approach to the docks.

"She's awfully big," Telly said. "She didn't look that big through the glass."

"They never do," Blake answered. "She looks new too, fresh sails and rigging."

"What's that on the foremast? Up near the masthead?" Telly pointed to a large circular housing containing a half-dozen blades resembling the shutters on a heliograph.

"Well, I'll be damned if it isn't a windmill generator," Blake said. "They've got electricity on board her. Look at the searchlights forward. Those aren't oil lamps, they're electric arc lights."

"Electricity," Telly whispered reverentially, as if Blake had said that one of Homer's Olympian gods was standing on the main deck.

"Here she comes," Blake said as the ship glided across the last few meters of open water, the last few yards of sail spilling the air. A rocket hissed to life from the shore, trailing smoke and nylon line in a long graceful arc over the bow of the schooner. A deckhand ran to snag the light messenger and was joined by a shipmate who began hauling a heavier mooring line out to the ship.

Mooring crews ashore and the ship's crew afloat worked the schooner up to the dock over the next few minutes. Now it was close enough for Telly to see the fine detail of the rigging, the bright-painted trim, the plastic and wooden fittings, the rare flash of brass and steel, all the special touches that showed the vessel to be the product of a wealthy anchorage and not a parsimonious float like his.

As soon as the ship was made fast to the dock, a gangway was pushed out from her gunwale. A moment later, a party of officers in white uniforms with stiff blue caps formed on the fantail.

"Come along, Telly," Blake said. Telly pulled his jaw up and shook the stars from his eyes, then fell into step behind his teacher. Blake moved quickly to join up with Pastor Kline, Council Leader Henry Adorno, Councilman Horatio Cady, and Nestor Cohn, the pharmacist.

The entourage clomped loudly down the dock, then filed across the gangway onto the ship and assembled facing the schooner's crew.

"Welcome aboard the *Relief,*" said a white-haired man at the center of the reception line, his face a mass of sunburned wrinkles that looked all the darker from the bleached white blouse that he wore. Telly ran his eyes over the elaborate insignia on the shoulderboards—the winged staff and serpents of the caduceus flanked by four gold stars. "I am Honor DuPage, master of the ship. These are our physicians—"

He indicated the three men and one woman to his right with a broad sweep of his hand.

"—And these are my officers." Another broad gesture indicated the four men to his left.

He introduced them by name,

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medical staff first, but Telly was distracted by the sudden shaking beside him. It was Duncan Blake, his arm quivering as he sought to raise it against some invisible restraining force.

"Malcolm," he whispered in a voice so soft and dry that Telly was sure no one else could hear him. Then he repeated it, more loudly. "Malcolm? Is that you?"

Heads turned in their direction, including that of the last officer in line to the left—a grey-haired man with sharp eyes and a beard that had long since gone white.

"And on the far end is our navigator," DuPage continued, trying to exercise discretion and ignore Duncan's interruption. "Malcolm Blake."

Duncan Blake stepped forward and took the *Relief*'s navigator by the arm.

"Malcolm, it's me—Duncan," he said, his voice cracking with emotion. "Your brother."

"Oh my God, Duncan. It's you!"

Then, before the assembled crew, physicians, and local dignitaries, the two men threw their arms around each other, pounded each other on the back, and began to cry.

THREE

Whether there was a real man named Noah who stocked the arks that carried our forefathers to safety when the Babbidge *slipped beneath the sea or not isn't really the question. Every time we honor him, we pay our due to those who rescued the precious links to our past on Old Earth.*

Some say that pulling tomato seeds and peppercorns from ration packs was a trick anyone could have come up with. And there surely were enough lemons around for all to plant.

The handful of books we have today were carried afloat by a half dozen families, and not by any single man. Indeed, some of them were copied in longhand from Earth-tech computers.

The real question of Noah is not whether one man contributed so much to our survival—both physical and spiritual. The question is how could anyone miss the lesson of those early days of humanity's life on Okeanos?

And the lesson is that we are all here today because of the sheer grace of God, that He gave us what we needed to live—food for the body and food for the soul.

—Aidan O'Hara, Year 83 A.F.

"What exactly is a twining?"

The question came from Hari Stoddard, the ship's youngest physician, and it brought all other conversation in the small wardroom to a stop. Those who were asking themselves the same question fell silent to hear the answer. Those who already knew the answer fell silent and tried to put it into words.

Telly found himself in both categories. He knew what he'd been told all his life, but still did not understand. All he was certain of at the moment was that the reunion of Duncan and Malcolm Blake was certainly a twining—and a big one.

His teacher had been so shaken by

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the meeting that it took him nearly half an hour to regain control of himself. When he did, he insisted that Telly remain with him and join the reception dinner for the *Relief.*

"I need someone to keep a watch on me," he said. "Make sure I don't lose myself again."

Telly's throat choked up at the request, and he nodded vigorously.

The people of Schenker Float put on their best spread for the hospital ship, including both sacred foods—juicy roast pork, fresh-picked tomatoes, fried green peppers, and cockatiel squab grilled on a spit—and profane—fish stew, pinefruit, breadroot, barrel fern, steamed crusties, and boiled submarine.

The *Relief* had provided its own treats—including one the likes of which Telly had never seen before. It was a cloudy liquid, with pieces of lemon floating in it. They called the liquid "lemonade." But the astonishing part came when they served it, pouring it into tall cups of clear blown glass. The cups had been filled first with what looked to Telly like chunks of raw glass, alternately clear and cloudy, fractured and cracked. He was reluctant to drink at first, until Duncan Blake urged him on.

"Go ahead, boy, try it. Ah, the wonders of electricity and refrigeration."

"We need it for the medical staff," his brother said. "They keep their samples and specimens in there."

Telly sipped it at first—it was sour and made his lips pucker. But more amazing, it was cold! Like deep water in a pond at dawn or seawater drawn up from a well in the center of the float.

"What are these things?" he asked.

"Ice, Telly," Duncan Blake said. "Water so cold that it freezes solid. They make it in a box belowdecks powered by electricity. Try and bite into it."

He did and received a rude surprise. His teeth hurt to touch it and his head ached in places he'd never felt before.

Once he got over the odd taste of the lemonade, he found himself swallowing it in great gulps. It made his skin prickle and cooled his face.

The ship provided more delicacies—fruits Telly had never seen before, though aside from the lemons they were all profane, and oversize crabs that they said were unique to Bishop Anchorage.

When they were done, Pastor Kline made the customary speech. "Thank Noah for his presence of mind to rescue the sacred foods that sustain our bodies, the sacred books that sustain our minds, and the sacred knowledge that sustains our community."

Everyone nodded, fresh glasses of lemonade were poured, and it was then that the physician asked his question.

"I take it you are not a Determinist, Doctor Stoddard," Pastor Kline said.

"Afraid not," he replied. He was a young man, his beard still dark and full, his eyes still bright, and his back still straight and strong. Telly felt the strength of the man's spirit. He might not have been a believer, but that did not mean he had no faith.

"A twining is an unexpected moment of unity—like the reunion of

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two brothers separated for much of their long lives," Kline said.

"Exactly like that," Captain DuPage said, with a knowing nod.

"And it is a sign of God's grace," Kline added. "A way of telling us that He has a plan for us."

"That's what I had heard," Stoddard said, slowly and carefully. Telly could see that the man was taking pains not to offend, even though he was not a believer. "But I don't understand how a coincidence like today's meeting implies the existence of God, His grace, or His plan."

"Ah, then you are a Skeptic," Kline declared.

"No, no," Stoddard said. "Not at all. You can call me a humanitarian if you want to put a name to it. I'm prepared to be convinced, but you'll just have to pardon my ignorance if I remain unenlightened. As I said, I simply don't understand how the one suggests the other."

"One has to put it into context," Kline said. "Think of it from God's point of view, humbly as you can, of course. Here on the North Einstein Gyre there are hundreds of floats—"

"Fifty-five hundred," Duncan Blake said.

Kline frowned, then nodded. "But of these, only a few are populated."

"One in five," said Stoddard.

"That many?" Kline queried, and this time Stoddard nodded. "In any case, think of how the hand of God had to steer Schenker Float and Malcolm Blake together. A few days sailing or drifting by either one and the two would never have come together. Malcolm and Duncan would never have reunited. Clearly this is evidence of the hand of God."

"Perhaps," Stoddard said. "But I don't see how it implies God's plan. That is the center of your beliefs, isn't it?"

"Certainly it is. But it is not simply a matter of rational deduction—the way the twining proves the existence of God. God's Plan is first of all a matter of faith. We believe He has a plan for us because it gives order and meaning to our lives."

"Precisely my point, Pastor," Stoddard said. "How do you get from the coincidence to the meaning? How do you know that the twining has anything to do with God's plan?"

Pastor Kline sighed, looking for words. Telly knew that he had reached his limits. He had seen the pastor in discussion groups before. He was good on the doctrine that he'd learned in seminary school—he was even competent at providing spiritual support for most of his parishioners. But he had trouble putting the pieces together from real life, from real things like today's big twining and the dozens of smaller ones that happened all the time.

Telly smiled, then almost before he knew what was happening, words jumped from his lips. "We don't," he said. "We don't know what the twining has to do with God's Plan. Not right now."

The others at the table all stared down at him, making his face feel hot and his forehead sweat. All were his senior, all except Malcolm's apprentice, Mark Wayland, who sat across the table from Telly. Wayland had a

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constant sneer on his face. It was a consequence of eyes that were too far apart, separated by the oversized bridge of his nose, and a chin that was too small. Now he seemed to be mocking Telly's boldness to enter into the conversation of adults.

"That's true," Pastor said, drawing the attention away from Telly and leaving him feeling terribly relieved. "We won't know what it means until we've discussed it. And we may not know even then. Sometimes the meaning of a twining doesn't emerge until days or weeks later. But let me assure you, when the meaning does become clear, there is no doubt that it was part of God's Plan."

"It sounds truly magical," Stoddard said, using such a tone that Telly could not be sure if he was in awe or if he was being sarcastic. "I feel deprived of the experience of such certainty."

"And well you should," Captain DuPage said. "It is a wondrous thing. Though to tell the truth, the way I've always seen it is that God's Plan is the duty to serve your fellow man, keep your honor, and protect your family."

"Ah, now that's a plan I could keep to," Stoddard said. "With or without twinings to prove God's hand in the matter."

"To be honest," Kline said, "much of the time, that seems to be what God is telling us." The pastor looked down the table, and his eyes fell on Telly. For a moment, he felt as if those words had been meant for him. And for a moment he felt a fierce anger at the pastor.

Anger because he did not want that to be God's plan for him. Not now, not ever. Because the way Pastor Kline interpreted those words, Telly knew it meant he should remain at home on Schenker Float with his parents.

And because Telly wanted to believe that the twining had a special meaning for him and him alone—that this ship was meant for him, meant to take him away to Bishop Anchorage and the Navigation School.

Telly cursed the tyrannies that set the limits of his life as he walked back home after the feast.

Chief among them was the slow crawl of time, of Okeanos itself making its long orbit of the Furnace. He looked up through the leaves at the white dot in the sky and tried to imagine a billion miles of distance between here and there. It was the long sidereal year of Okeanos that kept him prisoner here, a captive of his mother's will.

Until he had made one full circuit around that bright young star, he would not know the freedom he longed for. That journey took more than nineteen long watch-years—nineteen Christmases and nineteen Easters and nineteen Feasts of Aidan. Telly hated the bitter knowledge that seventeen was not nineteen. And that he was not yet a man.

He had hoped to sneak into his hut unobserved, coming up on it through the pigtail ferns on the far side of the rational, away from the pond. But the Furnace was still high in the sky, and the two dogs under his porch—Smokey and Harry—began to bark as soon

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as he was within earshot, running to him as he reached the edge of the yard.

"Telly, is that you out there?"

His mother's voice cut through the barking of the dogs, who were now alternately nipping at his feet and leaping into the air in front of him. She stepped out from behind the far side of the house, a broomstick in her hand.

Chryseis McMahon was a tall woman with long hair the color of a golden sunset. Her youthful beauty had not faded with age, but it had become twisted ever so subtley by the pendulum of her moods.

She had been sweeping the dooryard, as she did whenever the watchnight fell during side-day. Hour after hour, she would scour the ground. No fern or seedling dared show its face in her corner of the rational or in the common area around the cook stoves.

Scrack . . . scrack . . . scrack.

The sound of the broom against the dark organic soil built up over hundreds of watch-years would go on and on into the night. The shutters could block out the light of the Furnace, but not the sound of his mother's sweeping. She did it because there was nothing else to do—not after she had cleaned the hut, mended the clothes, and tended to the rational's nightly chores.

"Yes, Mother," Telly called to her. "It's me."

"Do you know how late it is? They sounded the nightwatch bell hours ago. Where have you been?"

Telly approached her slowly, dragging his heavy feet across the yard. He began to speak, to explain, but his mother cut him off.

"I know you've been up to something," she said. "I can tell when you're hiding your heart from me. Just look at you—all tied up in knots from holding it in. Well don't just stand there—explain yourself."

"I was down at the docks," he said. "I went there with—"

"That's what I thought. You've been out with that Skeptical girl again. That Eppie Borges. What have you two been doing? You know you can't let yourself get involved with one of them. What would your aunts say?"

Telly felt his heart pound, and his mouth grew dry. He wanted to tell her about the feast aboard the *Relief,* but he was afraid that if he started talking, everything would spill out.

His mother was unrelenting. She went on and on about the embarrassment he could cause if he and Eppie did anything as foolish as producing a child. "I would just die. Do you know that, Telly? I would just die."

Telly turned to his mother, took a step to close the distance between them, and put his hand on her shoulder. He waited until her eyes looked up from the ground and the broom, and met his.

"Mother, listen to me, please."

She hesitated, then softened. The fire and electricity that seemed to possess her soul faded, and she sighed. "You know, son, sometimes you look just like your father did when he was your age."

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"Mother, I wasn't with Eppie Borges. I was down on the ship that came in today with Duncan Blake. He invited me aboard for supper."

She fell silent for a moment, and Telly was satisfied that she had listened to his words and even accepted them.

But then she came about and took off on a new tack. "You were eating down there when we had food for you waiting at the table here? What a waste. No wonder we had to throw the leftovers to the dogs. Where are those animals anyway? They're good for nothing but food testing anyway."

Telly swallowed the lump in his throat and dragged himself wearily up the steps to his hut and into his room. He knew that he would not try to talk with her any more tonight. There was no point. When she was like this, it was hard enough to get her to listen to even simple things. It was best to just go along with her and leave the matter until she was willing to hear him out.

Except that it would be too late by then. The *Relief* was indeed staying only two watch-days. Their powerful electric searchlights let them find their way through the bergs and pontoons that littered the seas and made sailing during side-night such a hazard.

And with it would sail his hopes of flying away on the wind to Bishop Anchorage.

He dropped the blinds, casting the room into darkness, and sank to the sleeping mat on the floor. Outside he could hear the sound of his mother sweeping the yard as he drifted off to sleep.

Scrack . . . scrack . . . scrack. . . .

FOUR

For four generations, our people have argued over who was responsible for the Fall of the Babbidge *and its loss beneath the seas of this world. Some have blamed the First Navigator for her role in bringing the ship down—though they have honored her for bringing the five thousand souls aboard to safety on Einstein Float. Others have defended her, in the face of her own silence on the subject, claiming that she prevented a greater tragedy by saving our freedom against the plans of those ship's officers who went down with the* Babbidge.

But in all that time, in all those debates over guilt and blame, no one has ever questioned God's purpose in leaving us all castaways on a world without landfall, powerless before His grace, stripped of all certainty—even to our very location upon the face of His waters.

—Aidan O'Hara, Year 82 A.F.

By the time the discussion group began to assemble, the Furnace had settled nearly to the horizon. The air had cooled noticeably from the morningwatch's heat, and high clouds over the south end of the float were beginning to dissipate—though those that remained were painted gold and orange by the sunset.

Telly found Eppie at the edge of the village. She was not alone. Mark Wayland, the apprentice navigator, was with her. He was the last person

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Telly wanted to see now.

"I've never seen a Determinist discussion group before," Wayland said.

"I have, and you're not missing much," Eppie shot back. "Just don't tell my grandfather about it. Skeptics aren't supposed to show an interest in such things."

"Secrets shared are secrets safe," Telly said, eliciting a sudden glance of confusion, then understanding, from Eppie.

They found a place on the edge of the permanent seating—wooden benches set in great circles around the shore of the lagoon between the trees and the water. They set themselves down on the enchanted forest ferns that covered the ground like a soft mat.

The benches filled with older adults—Telly's father and mother among them, although his aunts stayed home. Perhaps a quarter of the float had turned out for the discussion, and half of them took seats near the water.

The air was full of the buzz and chatter of hundreds of conversations, punctuated by the shouts and cries of children running through the trees. Then a long procession emerged from the woods along the path out of the village, led by Pastor Kline and including the entire float council and the officers of the *Relief.*

When Pastor Kline reached the edge of the water and the rest of the procession took their seats along the line of benches, a hush flowed out like ripples in a pond.

"Welcome, my friends, to tonight's discussion group," he said, his high tenor voice cutting through the still air. "May we find our way together to understanding God's Plan."

Kline was as slight and vague in his words as he was in body. When he was younger, Telly had liked the pastor, largely because of his easy way with children and his eagerness to organize games and activities for them.

But as he matured, Telly had realized that his contribution to discussion groups was shallow and insubstantial. Tonight was no different.

"We've come together tonight for two purposes," Kline said. "The first is to recognize and honor our guests from the hospital ship *Relief.* We should thank them all for their kind efforts and their ministrations to our sick and aged. Let's hear a cheer for them."

The assembled floaters rose to their feet and individual leaders started the chant: "Hut-hut... HUZZAH!"

It repeated three times, then faded into chaotic mumbling.

"And the second reason for tonight's gathering is to consider the twining that occurred yesterday," Kline continued when order restored itself. "For those of you who have not yet heard—and I doubt there are many of you—the navigator of the *Relief* turned out to be none other than the long-lost brother of our own chief navigator, Duncan Blake.

"I think we should take some time together to discuss what possible meaning there might be in this event, bearing in mind that there are no clear messages from God and that His

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plan is always difficult to divine."

Henry Adorno, leader of the Council, was the first to speak. "Have either of the two brothers suggested any reason for their reunion?" he asked. "And do they have any suggestion that it might have some significance for Schenker Float?"

Duncan Blake rose from the bench where he sat beside his brother. "Malcolm and I have talked for two days of many things: our family, our lives over the years since we were separated by the war, the thoughts of two old men who've seen much of this world. But neither of us has come up with anything that would give God a reason to smile upon us by bringing us together once again."

"I fear we will have to go farther afield to find the meaning in this twining," Kline said. "It is often so, you all realize. God points with one hand while working with the other. And it is often great folly to go chasing after the sign while ignoring the act."

Others rose to speak, mostly mimicking the pretentious but empty style of Pastor Kline—but with less skill at oratory.

Behind him, Telly heard a loud sigh. It was Wayland, making it plain that he was bored and amused by the whole process.

"Silly people," he said once he saw that he had the attention of Telly and Eppie. "They argue about fantasies and imaginings. Can't they see that there is no meaning here? The two of them came together by chance. There are only so many floats in the sea and only so many navigators. Sooner or later, they had to meet."

"You know what the Skeptics aboard *Relief* think? They're calling it the Gilligan's Float Syndrome."

"The what?" Eppie asked.

"The Gilligan's Float Syndrome. It's based on an old story about a group of castaways on a lost float. In the course of their adventures, they are visited by just about everyone on the sea—as if theirs was the only lost float in the ocean. It's the same principle here. If you go to every float that passes by Bishop Anchorage, after a side-year or two, you're bound to run into someone you know. Even your long-lost brother."

Eppie laughed, but not sincerely. Telly just looked puzzled. It was a story and an idea he had never heard before. His first thought was out of his mouth before he had time to consider it. "But why now? Why not some other time?"

"What's so special about now? And why wouldn't you think it was special some other time? No—the problem is that you people are imposing meaning on a basically meaningless world. The doctors all think so—they're just too polite to say so."

Telly glared at the apprentice. Why didn't he reef his sails for the day? He was as wrong as the pastor. They both talked as if the sea was big and flat and endless. That lines went out into infinity straight and true without end.

But they did not. And Wayland, at least, should have known that. Every straight line to a navigator was actually a great circle. Head off in one direction and sooner or later, you were bound to return to where you started, but coming from the oppo-

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site direction. And every little piece of a line was a segment of a great circle. You could measure those arcs, find the intersection of the circles, and know where you stood.

That was the basis of navigation.

If the world were as flat and Euclidean as Pastor Kline seemed to think, it would all be a lot simpler. Plane trigonometry was a lot easier than spherical trig. But life was much more complicated. Cosines of cosines, sines of sines, angles of angles, all turning in on themselves, all returning to themselves. Like Duncan Blake's brother.

Telly wanted to tell Wayland what was special about this moment, but he could not. Not without leaving himself vulnerable to his scorn. Once again, he sought to avoid the other's arguments.

"Stow it, navigator," he said sharply.

"Don't tell me you believe all this?" Wayland said. Eppie gave him a look that said the same thing.

"I'm not sure what I believe," Telly said. "But I can do without your commentary."

Wayland looked surprised at Telly's brazenness and his refusal to suffer rudeness silently. He prepared to say something in reply, then stopped, seeming to think better of it.

Telly was glad. For once, he wanted to hear what Kline and the others had to say. For once, their words had a significance that Telly could not dismiss—at least not the way Wayland had just done.

He fell silent just as Kline was making another empty remark. Though to Telly's ear, this time it rang true in a way that the pastor could not have known.

"Most times, the message and meaning are plain and clear to those who are willing to look at what is before them," he said. Telly winced and wrestled with the contradictions of his faith once again.

Why was it Duncan whose brother had arrived? Why not the ship's master or one of the doctors? They could just as easily have had relatives here from before the war. Enough families had been broken up by it.

Because they were both navigators, Telly realized. And the twining clearly had something to do with navigation. And who was there when the *Relief* was first spotted? Telly and Eppie and a few others. But Telly was the one who wanted to go to Navigation School—more than anyone on Schenker Float. It was true before the *Relief* arrived and it would be true long after it had gone back to Bishop Anchorage.

It was plain and clear to the eye. But if it was true, if it was part of God's Plan, then what kind of a God did Telly's world have? One that would strand Duncan Blake here for a side-year to teach Telly navigation just so he could be here when his brother arrived to make a twining? One that would give Telly a mother who wouldn't let him go?

And if Telly couldn't go to Bishop Anchorage, what kind of message was He sending? Was it just some cruel joke He was playing?

"What do you think, Telly?" Eppie

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asked. "What does the twining mean?"

"I don't know if I want to talk about it with a couple of Skeptics," Telly said, immediately regretting the wounded look in Eppie's eyes. "I'm sorry. I shouldn't have put it that way."

"Just because I'm a Skeptic doesn't mean I think like him," she said, jerking her thumb sideways at Wayland. "There are different kinds of Skeptics. Some who don't believe anything unless they have evidence—and some who just don't believe anything. I'm the first kind, he's the other."

"I don't know what to believe," Telly said. Then he swallowed hard and took the risk of baring his soul to Eppie. "But if I was to take a guess at what the twining means, at least to me, it's pretty easy to figure out. This is my chance to leave for Bishop Anchorage and Navigation School. At least, that's what the pastor and everyone else seems to be saying. You're supposed to look at the simplest, clearest, most obvious meaning to these things, and that's what I come up with."

Wayland snickered. "I don't know which is funnier," he said. "That you could believe you're good enough to get into Navigation School or that you could believe it's part of God's Plan."

"I told you, I don't know what to believe," Telly said, the impulse to lash out at Wayland's insult nearly submerged in his own inner turmoil. "I mean, think about it. What kind of God would send a message like this?"

"The kind that would strand thousands of colonists on a world without a landfall and then sink the ship that held their equipment," Wayland said. "How's that for a sick joke?"

"Then I don't want to believe in Him," Telly said. "And I don't want to believe in His plan or His message."

Telly jumped to his feet and twisted his hands together in frustration. The last thing he wanted to hear now was more pointless rambling by people who didn't know what they were talking about.

He was so angry at the shallowness of the discussion that he stormed off from the assembly without even making a by-your-leave with Eppie or Wayland. He made his way into the woods, and took the path aft through Lagoon Village, cutting through to the edge of the sea on the far side of the settlement. It was a long walk, a few thousand meters, and took nearly half an hour—time that Telly spent rehashing the elements of his theological struggle to no particular effect.

By the time he reached the shore, the Furnace had set, bringing on darkness with tropical suddenness. The sky still maintained a burnished gold glow in the west, but the stars and planets and moons were already emerging.

Telly picked out the navigational stars quickly. Off to the north was red Antares, the pole star—or within a degree of the true pole. And to the east was the Navigator's Star—Iris, messenger of the gods, which patrolled Okeanos's Prime Meridian in a lazy figure-eight north and south of the equator.

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Achernar, the brightest star in Telly's sky, was rising out of the trees behind him. Aldeberan was high overhead, and Beta Centauris burned blue-white over the heart of Schenker Float.

Of the planets, only Hermes and Phoebe were visible, trailing after the Furnace as they descended into the western sea. And of the moons, only Calypso and Leucothie could be seen, one waxing full in the east and the other a slim crescent in the west.

Telly watched as the rest of the stars began to twinkle to life, naming those he could, casting about for the identities of those he could not.

And as he made his way through the sky, he lost his anger and frustration. There were still no answers, but the journey to the moons and planets and stars freed him from his float-bound troubles. He lost all sense of time and mass and social gravity, drifting upwards into the bottomless dark. His breathing slowed, his heart stopped its pounding, and his aching limbs relaxed.

He'd been there a long time when the skittering of a tree crab pulled his spirit back down into his body.

Then he saw that the tree crab had been disturbed by an intruder—Eppie. "Dr. Stoddard was a terrible bore, so I followed after you," she said. "What's wrong, Telly? You look terribly upset."

Telly scowled. He didn't want to talk to anyone right now. Then he saw the soft compassion in Eppie's eyes and relented. She was only trying to help, he realized, and could not be criticized for that.

"It's just me," he said. "All of a sudden my life is a mess, and I don't know what to do about it."

"Your mother won't let you go to Navigation School?" she asked.

"I don't know. I haven't asked her yet."

"I'll tell you what my grandfather would say, Telly. If you have to ask, you're not ready to go."

He felt suddenly sick at heart at that thought and snorted out a bitter laugh. "Thanks."

"I'm sorry," Eppie said. "It's just that you haven't looked very happy the last couple of days, and I want to help."

"I don't think you can."

"You can tell me what's bothering you. Are you still worried that your mother has other plans for you?"

"I don't know," Telly said. "I guess so. I don't know what I'm worried about now. When the *Relief* first got here, I was afraid that she would tell me it was God's Plan for me to stay right here on Schenker Float for the rest of my life. And I didn't want to believe in God's Plan because that wasn't what I had in mind."

"And you don't think that way anymore?"

"I don't know. Now I look at the twining with Duncan Blake and his brother and wonder if maybe there is a plan—and maybe it includes me."

"Then why don't you tell your mother that?"

"Because she's not that kind of believer," Telly said, realizing the truth for the first time. "She's one of those who thinks God's Plan is an excuse to keep doing the same thing year

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after year. Like Pastor Kline—it means pretending you aren't there, pretending you don't have dreams and plans of your own."

"And you think it means something else?"

"Maybe. Maybe God's Plan is something you have to figure out only for yourself. And it's different for everyone. Maybe you just have to listen to what He's telling you and never mind what everyone else says."

"Maybe," Eppie said. "Or maybe you're making it more complicated than it really is."

Telly looked at her face, but could see little expression in the fading twilight. He realized with a start how late it must be.

"We've got to go back," he said suddenly. "We'll be late for the festival." And worse than that, he thought, he might be too late to find his mother before she dropped off into the dark depths of her night mood.

"Do you really want to leave Schenker Float, Telly?" Eppie asked as they picked their way through the gloom to find the path.

For a moment he was ready to tell her how much he hated his cramped and limited world, where the only adventure consisted of a few brief years in late adolescence when boys and girls wondered which of them would wind up paired off with the other. But he thought better of it.

"I really want to go to Navigation School," he said. "Come on, let's go. Here's the path." He picked up the pace, almost leaving her behind as he nearly sprinted back to the waters of the Great Lagoon.

* * *

By the time he reached the waterfront, torches and oil lamps had been lit, the assembly of the discussion group had been transformed into the audience for the festival, and charcoal grills had been set up for barbecuing pork ribs, phib legs, and fish.

Telly arrived just as Duncan Blake walked into the glare of the footlamps set up along the front row of benches.

"My friends, before I begin tonight's presentation, I just want to thank you all for your kindness and attention," he said, with a bow and a sweep of his hand. "I am still in something of a fog at the reunion with my brother, but I would like to introduce him to you all now. For more than a side-year, we have been apart, but now we are together—Menelaos to my Agamemnon, Marc Antony to my Caesar."

Malcolm Blake stepped into the light and bowed his head at the round of applause.

Telly walked through the rows of benches, the smell of roasting meat drifting on the air around him, as he searched for his mother. She would be here somewhere—she never missed a festival.

"Tonight, I will continue with *The Iliad,*" Duncan Blake said when his brother had resumed his seat and the crowd had grown quiet again. "We left off last time with Book Five, which sings the praises of Diomedes."

Blake turned his back on the audience and reached down into a rucksack on the ground. He pulled out a leather helmet with a tall bristling brush along the crest and placed it

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on his head, then removed a wooden breastplate and strapped it loosely across his shoulders. When he turned back to face the audience, he had transformed himself into an Akhaian warrior, telling the tale of humanity's first and greatest war.

" 'No gods, but only Trojans and Akhaians were left now in the great fight upon the plain.' " Blake recited. " 'It swayed this way and that between the rivers, with levelled spears moving on one another.' "

He went on, describing the slaughter of the Trojan battlefield, Achaian and Trojan killing one another in intricate and bloody detail.

Telly spotted his mother and father sitting together at the end of a bench. They chewed on grilled phib legs, his father wiping his fingers on his tunic and his mother pulling the meat apart nervously.

He stopped and watched from where he stood, afraid to get any closer. If he sat with them now, his mother would only harass him and argue over imaginary problems. And there was no way of predicting where that would lead.

No, it would be best to wait until the moment was right. Perhaps at the end of tonight's Homer, before the play. His mother didn't like Shakespeare—it required too much concentration to make sense of the dialog and the plot. She would head for home when Blake was through.

Telly grabbed a small rack of pork ribs, using a leaf for a napkin, and found a place to sit where he could watch his parents, biding his time, as Blake told the story of Hektor's return to Troy.

Before Telly realized it, Blake's show was over, and the crowd was on its feet cheering. He lost sight of his parents and felt a stab of fear.

He saw them again, gathering their things together, a blanket against the chill of dark and a basket of food. They pressed their way through the crowd towards the path back to Workshop Village.

Telly struggled against the mass of people as he tried to follow them, growing panicky as the people closed in around him. Time was critical now. He had to catch his mother as quickly as possible. Her mood turned so swiftly, and there was seldom any warning. She would be approachable for only a short time. He tried not to think that it might already be too late.

Despite the crowding, Telly worked his way into the open in a couple of minutes, only a few dozen meters behind his parents. He raced to catch up with them.

"Telly," his father called when he approached. "I didn't see you back there."

"I was sitting in the back," he said, pausing to catch his breath, labored now from the sudden exertion and from his nervous fear. "Mother, I have to talk to you about something."

Telly studied her face in the flickering torchlight at the edge of the assembly area. She looked surprised and puzzled, but she seemed to have lost the hard edge of the day's frenzied rhythms. "Talk? What about? Are you in trouble?"

"No, Mother. I'm not in trouble. I need to talk to you about Navigation

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School."

Telly felt his body dissolve into nothingness. He seemed to float in the air before his parents, watching himself watch himself talk.

"Navigation School? What about it?"

"Mother, I want to go. I want to be a navigator. I'm Duncan Blake's best student. His best ever. He told me so himself. And he said he would get me into the school. And I want to go."

"But the Navigation School is in an anchorage," she said. Telly saw the shadows under her deepset eyes and the wrinkles around the shadows. She looked tired and older than her years.

"Yes, it is. In Bishop Anchorage. Where the *Relief* came from."

"Bishop Anchorage?"

"Yes, Mother. I want to go with the *Relief.* Tomorrow, when they sail for home." Telly felt the words clog in his throat. He was afraid, afraid to say what was in his heart. Finally they came spilling out, like water overflowing the edge of a bucket. "Can I go? Will you let me?"

Chris McMahon's eyes suddenly lit up as she realized what her son was asking. And just as suddenly they burned right back at him.

"Can you go?" she said, a harsh edge to her voice. "Of course not. What do you mean? You're just a boy."

Telly's heart sank, down into the ground, then below, to the depths of the bottomless ocean itself. He heard the rest of his mother's words, but he barely listened to what she was saying.

"You can't leave me, not now," she said. "I can't bear to lose another child. Not after all the others. And we're heading into the Chandler Drift. If you went to Bishop Anchorage now, you'd never find your way back to Schenker again."

"But Mother, I'd be a navigator," Telly protested. "I could find my way to any place."

"Don't be ridiculous. How would you know where to look? Who knows where the Chandler will send us? We could end up in the Newton Ocean or be caught in the West Wind Drift for a side-year."

"I'd still find you," Telly said defiantly.

His mother leaned back and looked him over. Telly studied her in return. This was no dark or manic mood. His mother was indeed as he'd hoped to find her—in full possession of herself. And it wasn't enough. He knew that now. It never would be enough. Nothing he could say or do would change that. He could argue about God's Plan, but to no avail. He could prove to his mother that there was no place on Okeanos that he could not find, given a sextant and a compass, but in vain.

He looked to his father, pleading with his eyes for support. But he knew there was no point.

"No," she said. "And I won't hear of it again."

The words had the finality of death.

Telly's parents turned and continued on towards home, leaving him standing on the path in his own darkness. And as they disappeared into the shadows of the forest, he remembered Eppie's words: "If you have to

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ask, you aren't ready to go."

It was true, and he knew it. If he were truly ready, he would have left right now, marched right into the quarterdeck of the *Relief* and asked for passage to Bishop Anchorage. But he could not. If he were capable of that, he would never have feared what his mother would say.

If he were capable of that, he would have already done it.

And he had not.

FIVE

The Lord never moves in a straight line. He never follows the schedule we set for Him. He seldom arrives when you expect Him to. But He is always on time.

—Aidan O'Hara, Year 83 A.F.

Twenty watch-days later, Schenker Float entered The Queue.

Telly tracked its progress as they shifted from their westerly course towards a steeper northerly track. Within a week, they were drawn into the Chandler Drift—and the wild ride began.

The first watch-day on the Drift brought them ninety-three miles to the northeast. The second carried them ninety-six. And the third brought them a full hundred.

The fluffy white clouds of the Equatorial Current were replaced by flat-bottomed gray clouds that hung low in the sky and clotted together to block the Furnace from view for hours on end.

The float's rationals clattered with excitement as people battened down against the possibility of foul weather for the first time in nearly a watch-year. Now that they were leaving the constant weather of the tropics behind, storms were more likely—and even the occasional rain squall could create turmoil for an unprepared rational.

It was almost enough to make Telly forget the pain of the visit by the *Relief*. Everyone else on Schenker quickly became absorbed in the urgent business of the preparations—almost as if they'd taken some drug that made them all more alive.

Even more intoxicating, however, was the rush of speculation over where the current would take them.

The Chandler Drift was a hundred-mile-broad river of water that stretched from the tropics all the way north to the Roaring Forties, more than two thousand miles in all. It climbed the western edge of the Northern Einstein Gyre, flowing at eight knots at the core of the drift and more than four knots along the edges.

It swept past Bishop Anchorage in the south, on up past Ellsworth in mid-ocean, then into the cold, brisk seas of the West Wind Drift, with their constant winds. To the east was the great wallowing heart of the Einstein Gyre, where floats drifted on the wind with no current to guide them, subject to the shifting breezes of passing weather fronts. To the west were the Chandler Banks, where the ocean bottom came within a mile of the surface, the fishing was always good, and the weather always unpredictable.

Where Schenker Float wound up would depend on where it left the Drift—inside the gyre, outside the

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gyre, or at its northern edge.

Telly refused to indulge in the speculation, keeping to his duties in the chart house, calculating their position by the Furnace and the stars, plotting their progress once each watch.

He was over his disappointment, but not his bitterness. He still did not understand what had happened when the *Relief* visited Schenker. He still did not know what to believe.

And when Schenker then drifted north of Bishop Anchorage he felt a sadness that he could not express.

He tried to talk about it with Duncan Blake. Blake had noticed his dark mood and mentioned it on their third day on the Drift. Telly had explained its cause—as much of it as he could.

"I can see your sorrow at missing out on Navigational School," Blake said. "But the other part of it is harder for me to understand."

"Me too," Telly said.

"It sounds like you went from putting no faith in your God to putting too much faith in Him," the navigator said. "There's only so much He can do at once, you know. He only looks all-powerful, but most of that is done with special effects—a little thunder over here, a chance reunion of lost brothers over there."

"But I was sure it was meant to be," Telly said, the full force of his dashed hope returning despite his efforts to hold it back.

"Now calm down there, laddy," Blake said. "That's your first mistake. You shouldn't be too sure of anything. Nine times out of ten—make that ninety-nine times out of a hundred—the lesson you're meant to learn from twinings and miracles and such is that you shouldn't believe too hard."

Telly shook his head. "What do you mean?"

"I mean that what you should do is let go of your faith, let go of your believing. Don't let them turn into a sea anchor. Remember, God's Plan is complicated and usually opaque. You seldom know which way the wind is going to blow, but when it does, you have to sail with it, not against it."

"That's just words," Telly said softly. "I don't even know what they mean."

"You will, lad," Duncan said. "Live a few more years on this wet world and you will."

It didn't take a few years, but only a few more days. The farther they drifted from Bishop Anchorage, the less it pulled at Telly's heart. And the more he realized the sense in Blake's words. He couldn't live on a broken dream forever. And he couldn't expect a single twining to be the only message God was likely to send his way.

After all, the Chandler Drift was carrying them quickly into new waters with new possibilities. Even if the tiny world of Schenker Float remained as boring and confining as ever, the seas and skies that Telly had made his own were shifting, slowly but surely, carrying him into an unknown and unknowable future.

Then, with a dozen watch-days behind them on the Drift, the storm hit.

It was not a big storm as such

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things went, but it was enough to keep Telly and his neighbors inside as the rain fell in great sheets, filling the ponds to overflowing and turning their drainage streams into torrents. The heavy wind whipped through the woods, stripping them of debris and plastering it against tree trunks and hut walls, gusting up to fifteen knots or more at the height of the tempest.

There had been worse storms on the other side of the gyre during their three-year journey down the Webster Current. Telly remembered several that had been accompanied by powerful lightning strokes and crackling thunder—both lacking here.

But the float had been better prepared over on the Webster Current. Here there were a number of chores that had been left undone—as evidenced by the baskets that flew by Telly's window and the crash of unlashed shutters on his aunt's hut.

The most dramatic effect of the storm, however, was not seen until after it had passed. Duncan Blake was the first to point it out, and Telly was the first to learn it from him.

When the rain and winds were gone, and the Furnace had burned through the fog that remained, Blake had come down from the bridge with the sullen look on his face.

"I guess that takes care of that," he said when he'd finished consulting his ephemeris and rechecking his calculations.

"What's wrong?" Telly asked.

"We've been blown out of the Chandler Drift," Blake said.

Telly's heart fluttered and his stomach churned. What did that mean? Had all the excitement been for nothing? Were they left to drift now in the wallowing heart of the Einstein Gyre?

"So much for the Nantucket Sleighride," Blake said. "We didn't even make it past Ellsworth."

"Are we stuck out here forever then?" Telly asked.

Blake gave him a look of mild astonishment. "Forever? Of course not. Nobody's ever any place for long on Okeanos, Telly. You should know that. No, we could blow back into the Chandler in a few days or a few weeks. Or we could drift to the east for a few months. It's hard to say now that we're out of the easterlies. It depends on the weather, to a large degree. But whatever happens, you'll be one of the first to know."

Despite Blake's reassurances, however, Telly still couldn't get rid of the unsettled feeling in the pit of his stomach.

Over the next week, he discovered why. Things were not quite as simple as Blake had made them out to be.

The weather was as unsettled as Telly's feelings. The skies were cloudy more often than not, and reliable navigational observations were not clearly as easy as they'd been in the watch-year he'd been a student in Blake's chart house.

After several plots, though, Telly was sure he had discovered something he could not understand. The positions appeared at first to be all over the place—first north, then south, then east. And then they were as much as sixty nautical miles apart.

Telly worked at the puzzle for hours, then it suddenly dawned on

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him. Schenker Float was traveling in circles!

"Very good," Blake said when Telly brought him his discovery. "Though not quite circles. We're caught in a wandering eddy."

"Really?" Telly asked. "I've heard of such things, but I didn't know they actually existed."

"They're quite real. And they're quite common. The Drift wanders back and forth across the sea, you know. There's nothing to keep it confined to any specific course. Sometimes it buckles up on itself, making a crook in its path. And sometimes the crook runs in on itself and breaks loose. Have you been down to the sea lately?"

"No," Telly said. "No reason to."

"You should go today. You'll see that the water is a lot colder than the Drift. And it smells of plankton and seaweed. We're in a cold-core eddy on the south side of the Drift. They move along to the southwest and rejoin the Chandler somewhere off Bishop Anchorage. They can be as much as a hundred miles across. We seem to be about thirty miles from the center of this one."

"It looks like we're moving fairly quickly."

"Yes, more than three knots. But in great circles. The eddy itself makes no more than a few miles a watch-day."

"How long before we'll be back in the Chandler?" Telly asked, suddenly apprehensive.

"The warm-core rings on the north side of the Drift rejoin after a dozen weeks or so," Blake said. "But the cold-core rings can take a watch-year or more to merge back into the main current."

Telly's heart sank. A watch-year suspended between Ellsworth and Bishop anchorages? The thought was almost too tragic to contemplate.

"Of course, we don't know how long this one's been out here," Blake was saying. "Conceivably it could turn back into the Drift almost any time."

But Telly wasn't really listening. He was sinking into the depths of his own dark mood instead.

Telly did go down to the sea and found that Blake was right. It was rank with the cold smell of seaweed. And when the float was on the leeward side of the eddy, a cool breeze came out of its core.

For the next ten days, Telly watched the sky, hoping for another storm to blow them free of their captivity, back to the Chandler Drift and on their way. The thought that he could still make his way to Bishop Anchorage and Navigation School was one that he tried to keep from his mind.

It was absurd, he thought, to believe in a God that arranged the affairs of the world to taunt a single solitary soul on an insignificant float in the middle of a vast and boundless ocean. It was even more absurd to believe that He would suspend that float midway between anchorages for an indeterminate amount of time just to prolong that soul's agony.

So Telly went on with his life, teaching arithmetic to the younger

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children each morning-watch, working in the woodshop each noon-watch, and continuing his classes in navigation twice daily. He kept his moods and his thoughts to himself, as he always had. And he did not think of the cruel ironies of fate—except on festival night, when Duncan Blake continued with his reading of *The Iliad.*

And after they had been prisoners of the cold-core ring for about three weeks, Blake called him into the chart house again to pose a new question for him.

The watch-day and the side-day had shifted out of phase sufficiently this morning that dawn was still a couple of hours away and the sky was filled with a mix of clouds and stars—mostly the former and a few of the latter. A damp, clammy wind pushed thickly through the forest. A large oil lamp illuminated the interior of the bridge.

"Good morning, lad," Blake said, so full of energy that it seemed an insult to the hour. Telly yawned and nodded in return. "You'll need to have more of your wits about you than that to solve today's puzzle," his teacher said.

Telly rubbed the sleep from his eyes and tried to look more alive. "What is it this morning?" he asked. "Are we leaving the eddy?"

"No such good fortune," Blake said as he brought out a plotting board that depicted the twisting spiral of Schenker Float's progress since being blown into the huge eddy. "Here, let me show you something. Back here, nearly two weeks ago, we were here at this point."

Blake put a short, dark finger on a plot marked with the numeral "10." "Since then, the eddy has taken a jog in its drift. We've moved off to a more southerly course from the southeasterly bearing we were on at first. Now look at where we are today."

He moved his finger to a spot where the spiral coiled up and the plots thickened. There was one marked "13" and another marked "17." A fresh one, unsmeared by further work, said "21."

"What's the puzzle?" Telly asked.

"Did you look at the sky this morning?" Blake asked.

"For a minute, I guess. Too many clouds to see much."

"Did you look at the clouds? Say, to the east?"

"No. You can't tell where you are from looking at clouds."

"That's true, lad," Blake replied. "But there are things you can tell from looking at them."

The wind was raw and damp. Telly could see that the clouds covered most of the eastern sky, with patches filling in to the west. He studied the clouds and saw what looked to be a touch of false dawn—a faint bit of color against their underside.

Then he looked again. It was too early for the Furnace to be peeking over the horizon.

"What is that?" he asked, pointing towards the color.

"What do you suppose?" Blake asked. "I spotted it myself more than a week ago, just after sunset. We've come back near this point once each side-day since, but always during the

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daylight. This is the first time we've returned when it was dark.

"Silly lad," Blake laughed. "Do I have to spell everything out to you? It's another float, by God's Plan. Not more than a few miles over the horizon. Those are the lights of their cookfires and lamps."

Telly felt embarrassed by his innocence, but resisted the impulse to use it as an excuse before his teacher. He just sighed appreciatively.

"So what do you think, boy? Do you feel like going a'calling?"

SIX

There will likely come a time in the life of every Navigator when he is called upon to do more than pilot his vessel through the waters of the world. Since the Fall, Okeanos has seen many eras of great trouble.

In the 3rd Century, we saw the Religious Wars as the Determinist Pastorate split over questions of doctrine. Within four side-years, the seas ran red again with blood from the Metal Wars as float fought float over the wealth dredged up from the sea bottom. And in our own lifetimes we have seen the Pirate Wars, with renegades seeking to profit from the growth of trade among the civilized peoples of Okeanos.

So clearly every Navigator—indeed, everyone who sets hull to water—must be prepared for battle.

—Foreword to *The Navigator's Guide*, published in the year 405 A.F. by the Navigation School, Bishop Anchorage.

"Rockets!"

Ivan and Eppie shouted together, but Telly knew before they yelled what had happened. The canoe had fired on them. He'd seen a sudden puff of orange flame torn away from one canoe by the wind, and a long thin cloud of white smoke begin to unreel in the narrowing gap between the *Prospero* and the war canoes.

The single-masted *Prospero* was large enough for six—Horatio Cady from the council as official representative of Schenker Float, Telly as pilot and navigator, Eppie Borges to run the heliograph, with Ivan Hayes and two others to fill out the crew.

It had taken more than two hours with a thick, sluggish wind behind them to reach the midpoint between the two floats. And when they did, they found they were not alone on the seas. A fleet of ten canoes filled with hard-stroking oarsmen cut through the waves.

And as they approached, two of the canoes had broken away from the main group and headed their way.

Telly had put the long glass to his eye and studied them carefully. Only a few thousand yards of metal-gray water lay between them. Through the glass, he could see the faces of individual rowers, though their expressions told them little.

Then he scanned across the length of one of the canoes in the center of the formation. Seated at its rear, rising above the others, was a man decked out in armor.

He wore a leather-and-wood-plate helmet that reminded Telly of Duncan Blake's Trojan headgear—only this one had a brush of a good foot

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long, painted bright orange, that gave the man the look of a giant. Straps and checkplates hung loose on either side of the helmet, revealing a face covered with a beard that was almost the same color as the brush.

More lacquered wood plates covered his breast and shoulders, and Telly could see a long spear grasped in one hand. The man was not rowing, but shouting commands.

A chill had run up Telly's spine. Who were these people? He couldn't imagine why they wished the people of Schenker Float ill.

The two canoes coming their way were full of men—twenty or more each. They were barely three thousand yards away when they fired the rocket.

Everyone on the sailboat had seen them by now, alerted by the warning shout.

Telly kept a white-knuckle grip on the tiller, not sure which direction to turn. Cady was no help, but sat amidships in a slack-jawed wonder at the approaching canoes.

He put the tiller over hard and the *Prospero* swung to one side, the mast tilting towards the sea.

The rocket seemed to hang in the air, growing steadily larger, but wavering not a bit from its course —which was straight towards them. Telly steadied up on a bearing that took them at right angles to the rocket's course. He held his breath, trying to coax the wind to blow harder, the seas to part, and the small craft to hurry on its way.

At the last minute, everyone aboard the boat turned their heads at once when the rocket soared past their stern harmlessly.

Telly barely had time to breathe a sigh of relief when he heard Ivan shout. "Here comes another one!"

This one seemed to be leading them slightly, and Telly turned again to avoid it. As he came about, a third missile was fired in their direction.

He felt a moment of panic, then shoved the tiller over in the opposite direction. The bow spun around until it was facing straight at the two canoes. The nearer rocket was almost upon them to port, while the other approached to starboard.

Each of them passed close by the *Prospero* and continued on to the empty sea behind it.

The canoes were due south of them now and less than a mile distant. The main body had continued on to the west and were now between the sailboat and Schenker Float.

Telly looked about, trying to decide what to do next. Not far to the north, a mile or two away, was a full-size pontoon more than a thousand meters wide and covered with low vegetation. He made his decision quickly and set course for its shelter.

With the wind off the port bow and picking up, the *Prospero* surged ahead. Ivan and his mates trimmed the sails, and they accelerated, the boat leaning into the long swells as if it were enjoying itself.

Two more rockets came their way, but Telly had set an oblique course that must have been hard to plot for the crews of the canoes. Both of them fell short of their target, and the canoes fell quickly behind.

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A few minutes later, they rounded the far side of the pontoon, putting it between them and the canoes.

"We've got to warn them back home," Cady said.

"What about it, Eppie?" Telly asked.

She looked up at the sky. "You don't have to ask me, Telly. You can see for yourself." The clouds were still there, bearing down on them from above like a shroud. There was no light bright enough to give the heliograph any use but making noise.

"Then we've got to get back," Cady said. "Turn the boat around."

"I certainly will, sir," Telly said. "But the wind is against us. I'm going to have to tack upwind to get to Schenker, and that'll take us longer than the canoes. I'm afraid there's little we can do."

Cady sputtered, and Eppie sighed. Ivan shook his head and looked as though he felt every bit as powerless as Telly did.

By the time they had circumnavigated the pontoon and set a course on a southerly tack, their two pursuers had headed back for the main body. According to Telly's calculations on the plot board, it would take them more than two hours to return to Schenker—if the wind held.

It did not. And long before they made their way home, plumes of thick white smoke began to rise from the float.

Since the moment Telly had returned to Schenker Float, all that was once familiar had been transformed into some grim nightmare from another world. Fire had swept the woods and rationals, the invaders had looted the storehouses, and the dead littered the ground.

A part of Telly's brain recognized the turnings and landmarks of the path, but the recognition only served to disorient him further. How could any of this be real? How could any of it be happening? It was like some scene from Homer or Blake's war stories transformed into real blood and fire.

He felt his heart drop into the cold sea beneath the roots of the world. There would be no recovering from some of the destruction the invaders had caused, he realized icily. Those who were dead were lost forever.

They passed through another ruined rational, where a storehouse had been torn open and its contents spilled across the yard—charcoal, sugar, dried meat, salted fish.

When they reached the edge of the village, Telly could hear the sound of men shouting commands, women screaming in horror, and dogs baying and howling, all set against the distant roar and crackle of burning wood.

Telly was drawn by the sound of the dogs.

He knew that they would be in the thick of the fight, reckless in their willingness to risk all in protection of their masters. Everything in his world had been transformed that way—from the elements of peace and oppressive harmony into the tools and setting of momentous battle.

The rationals of his village were like squares on a chessboard. The men and women and boys and girls

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he'd grown up with were reduced to pieces—some struggling bravely, others removed from the game. Every structure was a potential hiding place for the enemy. And every piece of wood, every bit of manufactured metal or plastic, had been transformed into a potential weapon.

He and Ivan drew closer now to the lines, becoming more cautious with every step.

Ivan looked dazed, in shock, and not just from the exertion of running across two miles of float. His arms and legs and face were striped with cuts and stained with bruises from crossing the young pontoon where they had clambered ashore from the *Prospero.* Telly looked down at himself and saw that he presented an equally damaged appearance.

The trees were thickest here beyond the limits of the village. The great boles of the steelwood crowded around them, and their thick canopies conspired to block out the light from above. Through the narrow gaps, Telly could see the daylight on the far side of the wood towards the workshops. He could even see figures moving here and there in the distance.

The shadows that clung to the forest floor made his nerves sing with tension. Who knew what lay here, waiting for them to make one misstep, one mistake.

The snap of a branch underfoot to his right sent waves of crackling energy up Telly's back. He cried out—a formless, animal sound.

But the shadow that emerged from the dark was not an enemy. It was Duncan Blake.

The navigator put a finger to his lips, then motioned for Telly and Ivan to follow him. To Telly's surprise, Blake was not alone, but was accompanied by two dozen men, all armed with long spears.

"We've maneuvered around behind them," Blake said. "If we do this right, we can upset their assault and break their momentum."

Telly nodded, but did not really understand. He only knew that Blake was the one bit of safety and security left in the madness that Schenker Float had become. He padded along with the rest of the platoon, wordlessly watching the action unfold.

They paused when they reached the edge of the wood. There, across a few dozen meters of open space, was the enemy line. There must have been a hundred or more of them—all backs and butts and armor and helmets.

They faced the workshops, pressing forward against strengthening opposition. As he watched, Telly saw a knot of men run screaming from the edge of the shops, flames clinging to their bodies. He noted absentmindedly that they were in the area of the plastic shops, where inflammable materials were in abundance.

Then a figure rushed out of the mass of invaders and began howling. It was the red-haired devil with his high-brushed helmet who Telly had seen in the canoe earlier that day. He carried a metal sword, blackened with char and blood, which he waved in great circles over his head. He paused to whack against his troops

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with the flat side of the iron and howl at them in words too distorted by rage and distance for Telly to understand.

"There he is," Ivan said in a low voice. "He's their captain."

"I suspect you're right," Blake whispered. "He looks like Hektor before the walls of Troy. Well, Hektor, time to meet your Achilles."

Blake whistled softly, then signaled to the rest of the war party. He pointed to the red-haired commander, and the men nodded in response.

Telly was ready too, but he realized that he had no weapon. He held his empty hands out to Blake. The navigator smiled and handed Telly a knife.

"Try not to think of Homer," he said. "*The Iliad* is such a slaughterhouse. Remember *Henry the Fifth*. 'Imitate the actions of the tiger, stiffen the sinews, summon up the blood, disguise fair nature with hard-favored rage.' "

He made a smile that looked unnatural on his smoke-smeared face and clapped Telly on the back.

Blake whistled again, and suddenly the party erupted from the forest, whooping and screaming and howling. They ran headlong into the rear of the enemy line, aiming straight toward the red-haired leader. Telly fell behind as they rushed on, exhausted by the afternoon's long struggle. Ivan looked back and halted, waiting for him to catch up.

By the time he drew alongside his mate, the main party had reached their target. Their spears were long enough to hold off the enemy warriors, and their speed was enough to overcome the commander.

Warclubs swung, but failed to connect with their targets. Spears flew, jabbed, drew blood, and struck again. Men shouted in pain and fear and anger.

And in the center of it all, Telly saw Duncan Blake, his aging face gripped with a fierce rage, wrestling with Big Red, the enemy commander. Red's sword was lost now, torn from his grip by the force of the fight. His men tried to rescue him, but the rest of the Schenker war party kept them at bay.

"Come on!" Ivan called. "Get in there!" Telly put on a final burst of speed and joined the fray.

Red's armor had blocked Blake's best blows, and Telly realized with a momentary panic that the men were too close together for Blake's spear to be of any use. If only he'd kept his knife instead of giving it to Telly. . . .

Ivan launched himself at the wrestling leaders, knocking them both to the ground. Telly flew after, drawing Blake's knife and clutching it in his hand.

The three of them tumbled across the ground—Ivan, Blake, and Red. Suddenly Red broke free. He struck at Ivan with a clenched fist, and Ivan dropped his warclub. They struggled over the club—Big Red fighting with what looked like inhuman strength.

Blake rolled away, stunned and out of breath. Telly felt cold fear run through his veins. He was only an arm's length away from the melee now, but uncertain of what to do.

Red swung his arm back, the war-

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club in his hand, preparing to strike a blow against Ivan. Telly saw a gap where the man's armor had come loose at his side, revealing pale white flesh.

The club began its forward stroke. Telly didn't even think. He plunged the knife into Red's side and held it tight against the man's ribs.

Red groaned and his arm fell, the warclub dropping to the ground. He turned abruptly, twisting the knife from Telly's grasp. But not before it tore a deeper wound in his side, the blood flowing freely.

He spun around dizzily, then collapsed on the ground.

"You think you have killed me," he said, staring up at Telly. "But you have not. It was fatal destiny that claimed me."

Telly looked around at Ivan and Blake and the Schenker war party. Then beyond them at the invading warriors, who now were turning their attention to the bloodshed in their rear.

A mighty roar of shouting voices rose from the workshops, as the defenders there suddenly burst forth from their makeshift fortifications. Telly could sense the sea change as the battle turned against the enemy. They fell back, shattered, disintegrating, demoralized by the loss of their commander.

The ranks of both sides swept past Telly and the bloody tableau on the ground, leaving him to collapse in nervous exhaustion, first falling to his knees, then to all fours, as Blake's war party circled around them for defense.

* * *

The defeat of the invaders was surprisingly swift and complete.

Once they had lost their leader and begun to retreat, they were broken. The larger numbers of the men from Schenker Float, angry and efficient warriors themselves once mobilized and armed, swamped the disorganized enemy. They captured the war canoes and slaughtered those who continued to resist.

In the end, about two dozen survivors surrendered, huddling together on the shore of Landfall Bay, surrounded by ten times their number, their backs to the water and their wounds running with blood.

For the next few hours, Telly was occupied by the grisly task of caring for the wounded and dead of Schenker Float. It was hard work both physically and emotionally.

The war parties quickly switched functions to search parties. They trudged through forest and fern looking for survivors of the attack who had sought shelter far from the rationals and workshops.

The unconscious ones were easiest to deal with, once Telly learned to handle the initial shock of discovery. Litter bearers were assigned to carry them to the makeshift hospital set up in the center of Workshop Village.

The ambulatory wounded were harder to take care of. Many were in shock, oblivious to their injuries. Some babbled on about what had happened to them, or to their loved ones. Telly didn't want to talk and couldn't even if he wanted to. He watched as older men applied first

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aid, lending what little help he could when asked.

Eventually his turn came to carry a litter, and he was relieved at the chance to escape the scene of so much destruction. The relief was short-lived.

"Telly! Telly McMahon!"

Pastor Kline called to him as he entered the village center. The pastor hurried to his side and took hold of the litter in his hand.

Telly was too numb to ask Kline what he wanted and too tired to wonder. But when they reached the hospital and set down their load, the pastor put a hand on Telly's shoulder.

"I'm sorry, my son, but I have bad news," he said.

Telly blinked and waited. His body ached and his tongue felt like a block of wood. "Yes?" he said, twisting the word out of his mouth.

"Your mother and father are dead," Kline said. "Along with your Aunt Cassie and her husband. The fighting went straight through your rational. The children are all right, but everyone else was hurt—or worse."

A man behind the pastor spoke up. Telly thought he looked familiar, but he couldn't recognize him through the smoke and grime that covered his face. "I saw the whole thing," he said. "Your folks fought hard, but there was just too many of them. They got your dogs too."

That was all it took to break through the heavy void that separated Telly from the suffering around him. The image of the poor helpless dogs lying dead on the ground somewhere, was too much.

He didn't feel the sobs that wracked his chest, nor the tears that ran down his face. He didn't feel much of anything for a long, long time.

SEVEN

For four side-years, our forefathers have struggled to survive on the face of the limitless waters. When their rations were expended, they found new foods among the flora and fauna of Okeanos. When their Earth-tech machines began to fail, they developed new technologies of wind and wood, plastics and polymers.

But having won their battle against nature, they lost their battle against the loss of their souls. For they never sought the meaning of their struggle. They never found a purpose for their victory.

And the penalty we see all around us in the countless forms of madness that afflict the lost souls of a race of castaways.

—Aidan O'Hara, Year 83 A.F.

The ragged woods that sprouted at random from Kronos Float looked empty from the sea, but that did little to dispel the sense of menace that filled Telly's heart as the *Hotspur* approached on a strong southwest wind.

The ship was loaded with warriors, ready to deal with whatever the invaders had left behind. But before putting the landing party ashore, they circumnavigated the home of the renegades. Blake's careful plotting and close inspection with the long glass revealed that it was not a normal

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float. It was less than half the size of Schenker.

"But it used to be full size," he said, explaining his findings to Henry Adorno, the council leader, who was now acting as master of the *Hotspur* and commander of the landing party. Telly stood beside him and listened.

"Are you sure?" Adorno asked.

"Absolutely. There's hardwoods and other vegetation on the lee side that come from the heart of a mature float. And you can see places where the original pontoons separated—here and here." He pointed to his crude but detailed map on a whiteboard. "It looks recent."

"I guess we'll have to learn why when we get ashore."

Adorno ordered the landing party into small boats. Blake and Telly waited until they had grounded and the signal came that it was safe to proceed before going over.

They came ashore on a young pontoon, maybe eight or nine side-years old. The vegetation was lush, with featherduster and pigtail ferns thick from water to wood. There were a few stands of spider trees, and the painful-looking spikes of aging spar trees linked together at the heart of the pontoon. The place should have been thick with tree crabs and phibs, but Telly saw no sign of them, something he thought odd.

The first sign of human habitation came at the far side of the pontoon, a mile from the sea. There were poorly kept huts surrounding yards littered with trash. Though empty, they looked recently occupied. And they looked old to Telly, as if they had been there long before falling into disrepair.

A gray-haired woman sitting in front of the last hut gave them directions to the float's central village, and the two dozen men of the war party pressed on.

"I knew they wouldn't be a'coming back," she said as Telly passed her by. She didn't appear to be talking to anyone in particular, just expressing an opinion. "I knew it—sooner or later."

They found the village on the far side of the float, its back against the open sea. This was where the pontoons had separated. Telly looked over the torn edge of ground to see roots and pumice and peat and soil exposed raw to the elements. Waves broke against the foot of a bluff a few meters below.

They found some of the survivors of Kronos in the village, mostly women and children, all looking hungry and lean. There were a lot of children, but most seemed passive and subdued. Telly thought they should have been more excited and playful, but they were fussy and squalling. Babies cried and clung to their mothers.

And Telly noticed that there were no dogs in the village.

But there were men there—some Downies, a few old men, and a handful of adult males who had been left behind because they couldn't be counted on to fight. One of them came forward, introduced himself as Thomas Nym, and told the story of Kronos.

"It was our own fault," Nym claimed. "We didn't keep the disci-

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pline you need to for life on a float this big. There were too many squabbles over duties and responsibilities. Too many tasks went undone. We're not religious like you Determinists. We were just too selfish to care about one another."

The hog farm had been poorly tended—a dangerous failing. They had let the poisons from the animals leach into the ground, killing enough of the native life to weaken the glue that bound the float together.

When a storm hit about a watch-year ago, the float had cracked in two. The hogs and many of the float's inhabitants were on the other half, which had broken into three smaller pontoons. "We lost the livestock—and more souls than we could afford," Nym said.

The shattered community that was left behind had all it could do to survive. If they'd been closer to the big anchorages or if they hadn't lost their only sailboat, they might have been able to get help. But the tragedy had struck somewhere in the heart of the Einstein Gyre, far from civilization.

They had stripped the float of its ready sources of food—phibs and crusties and much of the edible plants. They'd even eaten their dogs, and were losing the struggle to keep themselves alive on the few crops they could coax from thin gardens.

And then Ajax—Big Red—had arrived.

"He said that where he came from they talked to the gods. Not the one God of your church," Nym said. "The gods of Homer—Ares, Apollo, and Athena. He got the younger men excited. Told them that he'd been sent by the gods to save the people of Kronos."

He also taught them to turn some of the floats' inedible plants into a mash that they could ferment and distill. Then he led them in long sessions of mad intoxication with promises of food and glory for those who joined him as warriors to prey on nearby floats.

"We figured that folks would just as likely help us as not," said Nym. "But we didn't dare say so. Those that did aren't around anymore."

Telly felt cold sympathy. A lot of people weren't around anymore, thanks to Ajax.

Telly still felt vaguely unsatisfied.

They'd found their explanation, but it didn't explain anything. A drunken renegade and a float full of starving misfits—that was all there had been to it. Nothing romantic or malevolent beyond the ravings of a single man.

But he wanted to know more about the man who had caused so much pain and suffering—about the man he had killed.

So when they began searching the village for the rational where Ajax lived, Telly was quick to volunteer. They followed Nym's directions and headed aft. Before long, they came upon a high-walled stockade enclosing an area about a quarter the size of Telly's rational back home.

The fence ran off to either side of a large hut sitting in the middle of a thick stand of conifers. As they drew closer, Telly saw that the place was

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marked with gruesome trophies—strings of human teeth, the skulls of pigs painted in bright colors, charred warclubs and broken spears. It set the skin on his back aprickle.

No one in the war party said a word, but the man in the lead held up a hand, and everyone stopped. They stood there in silence for a long time. Telly wondered if they all felt the same sense of haunting presence that he did—the feeling that Ajax and his warriors were still somewhere about.

When it was clear that no one was hiding in the dark corners of the woods, they continued on into the building.

The place was a mess, plain and simple. Baskets of sugar and dried meat and rotting vegetables littered the floors and piled in the corners. Heaps of charcoal sat before a metal stove, which Telly suspected had been stolen from one of their earlier victims. And weapons lay tossed helter skelter in every room.

In the rear of the hut, they found plastic jugs filled with foul-smelling liquids. Some were clear and bitter, others were dark and sour. They surrounded a collection of pipes, tubes, barrels, and bottles, all scarred by charcoal fires and dripping potions.

Telly touched a finger to the clear liquid and tasted it. The flavor was dozens of times worse than the smell, and the stuff made his throat clamp shut.

The yard was overgrown with ferns and included a small copse of mast trees in one corner. The war party converged on the trees where their leader sounded the rally cry.

Telly was one of the last to arrive, and when he reached the center of the trees he was horrified by what he found.

A thick beam had been lashed between two trees, with pegs protruding from its length and from the boles of the trees themselves. Hanging from the pegs on the trees were cruel pieces of wood and metal with handles at one end, and hooks and points and barbs at the other.

And hanging from the main beam were the bloody remains of what had once been a human being. He looked like he'd taken a long time to die and was glad when death finally took him.

At first Telly avoided looking into the man's face, reluctant to give the hanging meat the form of humanity. But when he did finally look into the lifeless eyes of the corpse, he recoiled in shock.

It was Mark Wayland.

They held the trial for the twenty-seven surviving followers of Ajax at the beginning of the next noonwatch. It was the night-cycle of the side-day, and the proceedings were held by torchlight. The flames of the torches made shadows dance eerily across the ground.

The court consisted of the seven members of the Schenker Float Council. Henry Adorno presided. Duncan Blake stood as prosecutor. Pastor Kline spoke for the defense.

It took no more than half an hour.

Blake presented the events leading up to the invasion, which the council secretary recorded in a leatherbound log with pages of precious paper. He

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summarized the battle, then listed the terrible cost of the invasion. So many kilos of sugar, grain, pork, charcoal, and salt despoiled by the looters. So many dozen huts destroyed or damaged by firebombs. Fifty-three men, women, and children killed, and more than two hundred injured by the fighting.

"By their deeds shall ye know them," Blake said. "The Law of the Sea is clear. In the name of our lost friends and family, I ask for the full penalty."

Pastor Kline's defense was neither long nor spirited. As with his sermons, Telly was not swayed by it in least. Kline asked for mercy, pointed to the culpability of their dead leader, and warned that men are easily led astray by false prophets.

The warriors, tied to one another with shining nylon line, sat sullen-faced and silent. As Telly watched, some tended to their wounds, while others shook with tremors caused by a combination of nerves and cold flesh.

When the testimony was over, the council members huddled closely for a few minutes to discuss their verdict. It was what everyone expected.

"You have violated the Law of the Sea, as drafted during humanity's long struggle with itself on the waters of Okeanos," Henry Adorno said solemnly after rising at the center of the long table. "The facts are clear. The evidence unchallenged. Your identities are known and unmistakable. Therefore, this court finds you all guilty as charged with the crime of piracy on the high seas. The penalty for your crime is death. Sentence is to be carried out upon conclusion of these proceedings."

A murmur passed through the prisoners. Some cried out. Others simply cried. No one from Schenker Float cheered. But neither did they express any remorse for the condemned men.

A short while later, with as many of Schenker Float's population watching as Telly had ever seen massed together, the execution was carried out.

The warriors, still bound together, watched aghast as the heavy line that bound them was lashed tight to a ballast log—a hollow tube filled with crushed pumice. A half dozen men carried the log to the edge of the Great Lagoon, where Henry Adorno stood beside the council secretary with the logbook. The prisoners were lined up along the edge of the dark water.

Henry said a few words that were snatched away by the wind.

Then the ballast log was thrown into the bottomless waters of the lagoon. In one swift motion down the line, the warriors were pulled in with it, one after the other in quick succession, reminding Telly of the tearing of a rotten waterskin. Some gasped, some yelled, some scrambled to avoid their fate at the last instant. But within a minute, they were all under the sea.

In a few days, when the bones were stripped clean and had fallen free from the line, the ballast log would be recovered. Little was ever wasted on Schenker Float.

* * *

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That evening, while it was still dark, they held the funeral for those killed in the battle.

The pyre was large and nearly filled the treeless verge outboard of the boatyards in Landfall Bay. A lot of charcoal and firewood would be consumed this nightwatch—almost more than the float could afford. But there was no choice. The remains of loved ones were not left to the merciless tenders of the gyre's deep.

Oils were poured on shrouded bodies, and sweetwoods were stoked around the pyre's fuel. Grief-stricken family members lingered at the sides of their dead, though Telly could not bring himself to cry here in the open. He'd already said his farewell.

Pastor Kline read the words of the service, but Telly didn't hear them. He watched the way the torches danced in the wind. He remembered the faces of his father and mother, their voices, their words.

Then the pastor walked the length of the pyre, setting his torch to the fuel. The fire was slow to start, but then roared to life when it reached the oil-soaked shrouds. The smoke rose thick and black into the star-filled sky.

Telly waited until he could feel the heat from where he stood, then approached the point in the pyre that held his parents. When it was almost too hot to stand, he stopped, looked one last time at the broom in his hands, and threw it into the flames.

Then he returned to the edge of the wood, where he sat on the ground, and waited for the fire to burn itself out.

* * *

EIGHT

Our forefathers here on Okeanos would tell you that we live in a universe indifferent to our presence. Nature does not care what we think, it follows its rules whether we believe in them or not.

But that is the material world.

We also live in a world of the spirit. And that world is not at all indifferent to us. On the contrary, we are at its center. It is a world rich in meaning. Everything is connected in this world, and everything has meaning. And because of that, God's Plan can always be seen in this world.

This is the world of irony and coincidence, of history and society. Learn its rules, and you will learn how the mind of God itself must work. Read its meaning, and you will see the Plan of God.

But the choice is yours.

We do not believe in the meaning because we can prove it. We believe in it because we choose to. Because we prefer a world of meaning over one without.

—Aidan O'Hara, Year 87 A.F.

Part of the mystery that lingered in Telly's mind was solved when the *Relief* arrived several days later.

Wayland had been aboard a ship sent out by Bishop Anchorage a few weeks ago on a routine patrol. The vessel was to have returned within the past week but when the *Relief* left for Schenker it had still been overdue. When told of the discovery of Wayland's body Master DuPage, who was aboard the *Relief*, was sure that the

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ship had been lost—another victim of Ajax's warriors.

Nym had given them little information back on Kronos. He claimed that he knew nothing about what went on within the stockade, though Telly felt he knew more than he would admit.

Telly had had time to think while waiting for the *Relief* to arrive, time to sort things out. Some things still remained unclear, but he had come to a number of conclusions.

No matter what the immediate cause of the young apprentice's death, Telly could not help but see a more removed meaning.

It was his own personal twining. Or so it looked. Telly had come to grow suspicious of the meanings of events.

If it was a twining, then its meaning was clear. As was the entire encounter with Kronos Float. Certainly the consequences were.

"I'm going," he told Eppie the night the *Relief* arrived. They were on the bridge together, shooting the stars in a clear sky marked by three small, bright moons.

"That's what I was afraid of," she said.

"Afraid? Why?"

"Because I love you, Telemachus McMahon," she said. "That's why."

Telly was glad that the night hid his face and that Eppie could not see him blush. He realized that he was only dimly aware of the truth of what she said. And he realized that he should have been more than dimly aware of it for a long time now.

"I know," he said. He didn't add anything, though he was sure she was waiting for him to.

After a long silence, she said: "What do you think now? About your mother and about things?"

"You mean am I a believer? Do you think I'm following God's Plan?"

"Sort of," she said. "You seemed so troubled about it before."

"A lot has changed since then," he said. "I still don't know what to believe, but I know what I think."

"What's that?"

"That no matter what you believe, things still look like they've been arranged by God to accomplish what He wants."

"Are you sure it's more than just appearances?"

"No, I'm not," he said. "In fact, I lean more toward that idea than the other. But I think that's because I don't want to believe in a God that would do all the things that He must have done to bring me to this point."

"Neither do I," she said. "So what's the problem?"

"I'm afraid that my own feelings may be slanting my judgment. And that maybe there is no simpler explanation than that. Maybe it is God's Plan."

"Is that why you're going?" she asked, her voice threatening to crack on the mention of Telly's plans.

"No. I'm going because it's what I want to do—what I've always wanted to do," he said. "And I'm going because now I'm free to go. And because even if my mother was alive, I've reached the point your grandfather talked about. If you're ready to go, you don't have to ask."

"I wish I could change your mind," she said.

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He made no reply. He didn't want to hurt her feelings. But he knew there wasn't a thing she could do to alter his course.

There were other things he could not tell Eppie. He was reluctant to share what had become a terribly private vision.

Because now he knew deep in his soul how the first colonists must have felt after The Fall: alone, stripped of all connection to the past, faced with a monstrous and vast uncertainty. No wonder they finally came to believe so strongly in the certainty of the Determinist faith in God's Plan.

But Telly knew he was different. He knew that he had what it would take to face that uncertainty. He knew how to be a navigator.

Where are we? We are right there in the middle of an endless sea. Every day our position changes and every day we must recalculate it, and we will go on doing that until the day we die.

That's what ties us to our past. That's what makes us human.

—Unknown navigator, Year 0 A.F. ■

Forms are for mediocrity, and it is fortunate that mediocrity can act only according to routine. Ability takes its flight unhindered.

—Napoleon I

To an alien studying the news media of Earth, it would seem that by far the most important area of concern on this planet is spectator sports.

—Kelvin Throop

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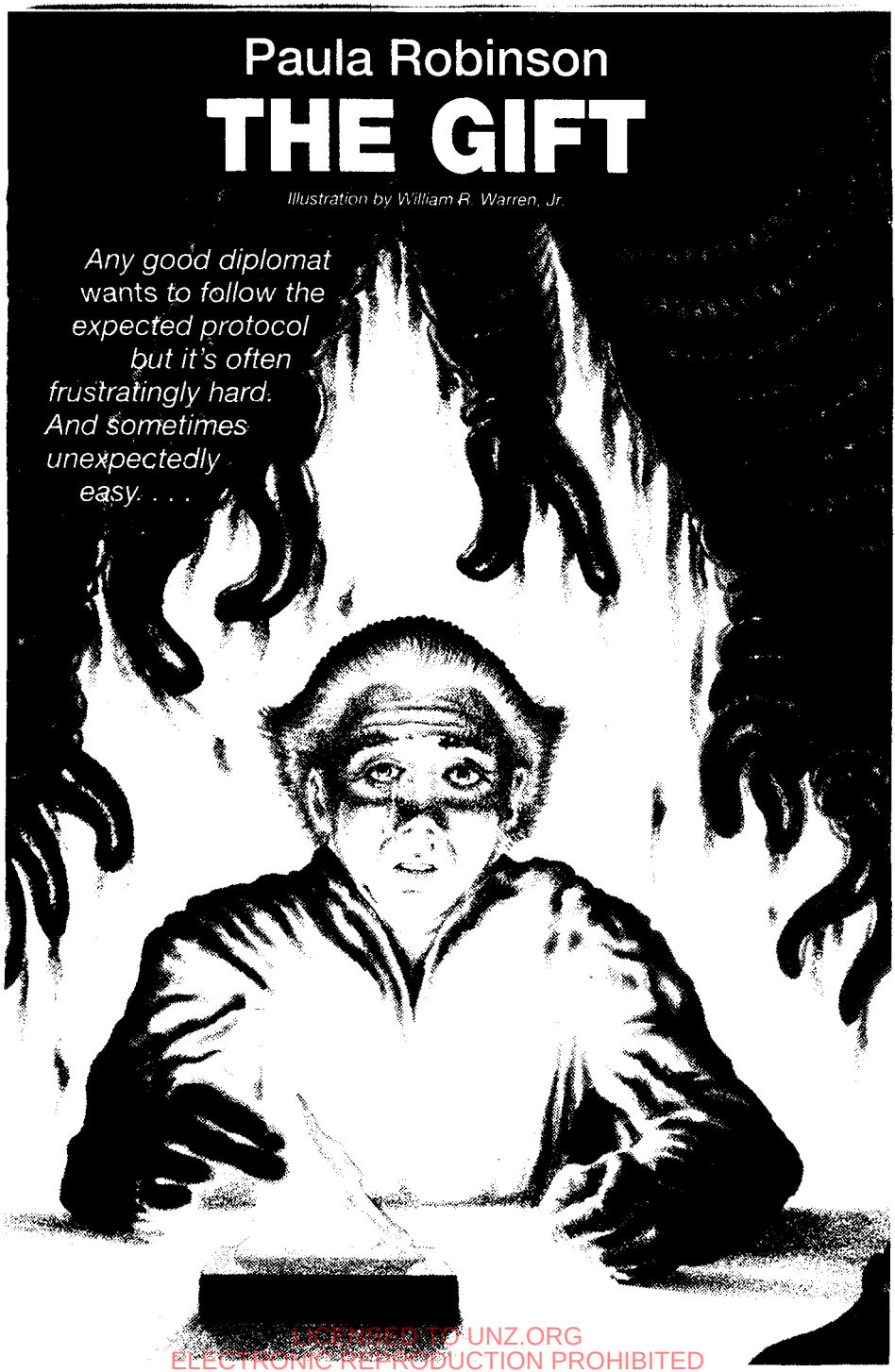
Paula Robinson

THE GIFT

Illustration by William R. Warren, Jr.


Any good diplomat wants to follow the expected protocol but it's often frustratingly hard. And sometimes unexpectedly easy. . . .

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"Yecch," the captain said.

Diplomat Max Douglas had to chuckle, but his laugh quickly dissolved into a fit of coughing. The captain was right: the Segoori were definitely unattractive by human standards. The image displayed on the computer screen resembled a squid or snail with a scaly rash.

"What's that crud?" the captain asked.

Max sneezed. "Dead skin, basically. Their home environment is very rainy. Keeps them moist." He mopped at his nose with a tissue.

The captain looked from the computer screen to Max. "How long will you have that, uh . . . what's it called?"

"Cold. I have a cold." Max blinked irritably. Everyone he'd seen in the past three days had asked about it, so he volunteered, "You know how the med staff circulates genetically defused viruses to keep our immune systems healthy? Well, I just happened to get the one that mutated back to its original form."

"Will I get it?"

"No. As soon as I got sick, they fed a vaccine to everyone else." Max blew into a tissue, hard. *"You'll* be fine."

The captain nodded and turned to leave.

Gee, thanks for the sympathy, Max thought sourly. He was particularly annoyed that he had to be sick while dealing with the Segoori. They were known to be petulant—probably because of their own discomfort, what with their skin peeling. It seemed their interdimensional drive couldn't operate unless the entire ship maintained certain temperature and humidity levels. The Segoori were forced to trade physical comfort for speed. This made them characteristically cranky, and that didn't make Max any too glad. The drugs the med staff had given him made him dopey and still didn't knock out the cold symptoms. How he was supposed to negotiate rights to four planets with all the distractions, he couldn't say.

But negotiate he would. The Segoori ambassador, Seven Tentacles With Spots, would come on board in three hours. Tension had developed between mankind and the Segoori over a small string of habitable worlds in the third sector. The Segoori had colonized two before the human population filtered into the area, but the remaining four were claimed by both sides.

Max had been ordered to procure at least three of those worlds, but unfortunately the Segoori didn't seem interested in sharing.

"Excuse me? Mister Douglas?"

"Mm?" He glanced at the vidphone, preoccupied.

The image of a young technician fourth class, a.k.a. janitor, appeared. "Sir, I was told to contact you for instructions. Are there any special conditions the Segoori ambassador will need? Temperature, humidity . . . ?"

Max sniffled as he reached for the folder. "I'll leave instructions in the computer."

The young man nodded and disappeared.

Squinting at the folder through his bleary eyes, Max put hand to keyboard and typed. He quickly entered the data and cleared the field without

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so much as a glance, not seeing the typographical error in the temperature column.

"Ah-*choo,*" he said.

Seven Tentacles With Spots waited impatiently in the meeting room. He wondered if the humans were seriously interested in the contested planets. Although the moisture in the room was welcome, the temperature was far too low, making his damp, dead skin hang in chilly clumps. He was tempted to refuse to negotiate at all until the climate was properly adjusted, which might never happen since asking outright was against protocol. Only the realization that the longer he delayed, the longer he would have to stay made him tolerate the discomfort.

The fact that his own ship environment was even less pleasant was irrelevant. The humans were not constrained by the requirements of an interdimensional drive. If they couldn't be bothered with making him comfortable, then maybe he, Seven Tentacles With Spots, wouldn't bother to please *them,* either.

He scratched his soggy, flaking skin and hissed. Where was this Max Douglas? Did he habitually keep his fellow diplomats waiting? Seven Tentacles With Spots had been in this unpleasant room for over seven of the humans' minutes. He vowed to make the human diplomat sorry if he had to wait much longer. Not that he was surprised by the humans' incompetence. What other beings would want him to grant rights to four planets without so much as a pre-negotiative gift? One did not accept something in return for nothing. If they wanted their precious planets, fine, but they'd have to come up with a particularly clever offering first.

Seven Tentacles With Spots was about to complain into the intercom when the door opened and Max Douglas appeared, holding a box of tissues.

"I beg your *pardon,*" Max begged, trying—unsuccessfully—to appear dignified as he blotted his nose.

The Segoori ambassador didn't look happy. Max wasn't sure he could read the Segoori's face and body language yet, but the wet patches of dead skin looked terribly uncomfortable.

Clearing his sore throat, Max concluded that the negotiations weren't likely to be easy. "I'm—ahh," he stammered, and had a sneezing fit.

The Segoori ambassador blinked, eye stalks rigid, and hissed.

No, Max thought, *this doesn't look good.*

In the middle of the third day, Seven Tentacles With Spots demanded a recess. Max hated to grant it—he had gotten the ambassador to cede rights to only one planet—but he didn't argue. After all, his cold was worse than ever. The low temperature in the briefing room wasn't doing him any good. He just hoped the ambassador appreciated the adjusted climate.

He went to the nearby lavatory. The face in the mirror looked years older, with puffy eyes and a red nose.

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Max moaned, snatching a tissue.

He was confused that his briefing hadn't mentioned a pre-negotiative gift. Seven Tentacles With Spots seemed offended that he hadn't received one. Small wonder the Segoori ambassador was in such a foul mood. In addition to being physically uncomfortable, he also believed he'd been insulted.

Max went to a bench across from the faucet. Rubbing his face, he wondered what he and his fellow humans had that the Segoori would value. Seven Tentacles With Spots wasn't apt to be easily impressed. The Segoori were well ahead of man technologically. What they didn't have, they could synthesize, and they found mankind's most sophisticated equipment laughable.

"Mister Douglas?"

Max looked up. The young janitor was peering in the door.

"It's the ambassador, sir," he stammered. "He, um . . . *left.*"

Max groaned and rested his stuffy head in his hands.

Attempts to speak with the Segoori were met with icy silence. Exhausted, Max asked the captain to call him if anything changed, and went to his *quarters to rest.*

The buzz that woke him an hour later seemed to come from the ache deep in his head. Max sat up on the bed, his tongue dry from mouth-breathing, and activated the vidphone. "Yeah?"

The captain's face appeared. "The Segoori are threatening to fire on us," he said tersely. "Meet me in the briefing room."

Max entered the room coughing. The captain glared disapprovingly, his gaze quickly returning to the ship-to-ship vid, where the image of Seven Tentacles With Spots loomed.

". . . Obvious deliberate act of provocation," the ambassador was saying. "I do not understand your motive for infecting me with your virus, but—"

"Infecting him?" Max blurted. He turned to the captain, eyes wide. "I thought the med staff said non-humans couldn't get our viruses!"

"Apparently they were wrong," the captain whispered. "Look at him."

Indeed, Seven Tentacles With Spots looked different. Although he wasn't coughing or sneezing, his skin was covered with a thick sheen of mucus.

"Yecch," Max said involuntarily.

"You are given one-half hour to provide a cure before we begin aggressive measures," Seven Tentacles With Spots concluded. With that his eye stalks lengthened—a sign of anger, Max guessed—and the screen went blank.

"The med staff says it'll take them at least two days to figure out how to cure a Segoori," the captain said. "I *called their ship, but the minute I said* we needed their help they got nasty and hung up."

"Sounds like they don't like the virus any more than I do," Max mumbled.

The computer interrupted their conversation by announcing that the Segoori ship was armed.

"I hope you can get us out of this,"

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the captain said hoarsely.

Max responded by swearing quietly. He suddenly realized how grossly unprepared he was. All mankind knew about the Segoori, really, was what the Segoori had told them—and obviously that wasn't enough.

The captain stared at Max. "What now?"

Max coughed and cleared his throat. "I don't know."

"We can't fight them. Hell, I don't even know how half of their stuff *works.*"

"Can we outrun them?"

"Not with their interdimensional drive."

Max wiped his nose. "Then pray."

The half-hour deadline arrived and passed without the threatened attack. Max and the captain were debating what to try next when Seven Tentacles With Spots suddenly appeared on the vid.

The Segoori's skin had become smooth and moist. The patches of dead skin were gone, replaced by a sleek, healthy-looking sheen. Seven Tentacles With Spots's eye stalks now curved slightly—a sign of pleasure, the notes had said—and his manner was much less tense.

Max began to speak, but Seven Tentacles With Spots interrupted.

"I must commend you, Max Douglas, for your excellent gift."

Max's brows knit. "Eh, you're welcome, Seven Tentacles With Spots, but—"

"You must excuse our earlier transmissions. We did not then realize that the virus was a pre-negotiative offering." The Segoori's eye stalks bent a little more. "We had been unable to find a suitable drug to increase our mucus secretions. Using a virus to do so is quite clever. We are deeply grateful for the relief." His eye stalks were now nearly bent double. "I hope you will allow me and several of my companions to come onboard."

"Uh, sure," Max stammered.

"We would be grateful if you could provide us with a supply of the virus." Seven Tentacles With Spots paused. "My companions are eager to be infected. May we come over now?"

"Yes," Max said, managing to rush the word out ahead of a string of sneezes.

"Excellent." Several other Segoori appeared behind Seven Tentacles With Spots, their skins still peeling and dry. "We will see you soon, then."

As the screen went blank Max looked to the captain, whose mouth was still open in surprise.

"I'll need a supply of cold viruses," he said. "Real ones. The kind that make you sick."

The captain nodded dumbly. Realizing his mouth was still open, he shut it, then blinked. "I guess I should go greet them for you."

"Please do," Max said, a smile—his first since he'd developed the cold—tugging at his lips. It seemed that the negotiations were going to be much easier now. "I'll be along after I speak with the med staff."

With that, Max Douglas grabbed a tissue and ran to the hallway, fervently blessing his runny nose. ■

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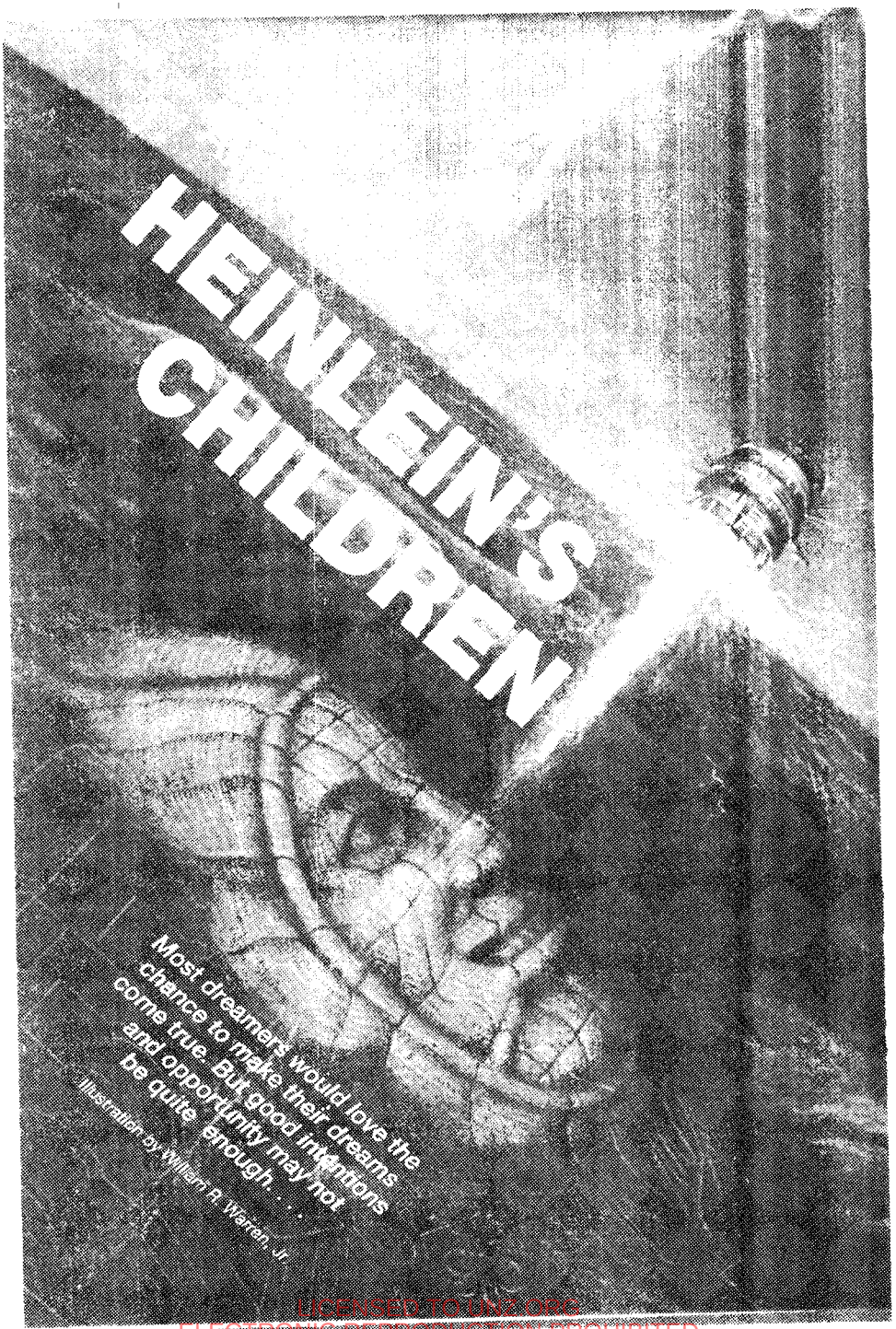
HEINLEIN'S CHILDREN



Most dreamers would love the chance to make their dreams come true. But good intentions and opportunity may not be quite enough. . . .

Illustration by William R. Warren, Jr.

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"So, they're finally coming after me, after all these years?" I say to my wife, who is standing over my patio lounge chair, awaiting my reaction to the news she'd just seen on the video. I turn my head to hide my tremulous emotional reactions from her view. *I've always heard the expression, not knowing whether to laugh or cry; only now do I realize what it means.* A knot forms in my throat. *It's been worth it, but now that it's over.... Hell,* I admit to myself, *I'm still afraid. After all these years.*

Joyce, however, can't hold back the tears. "It was just on the news, honey. They're looking for you. 'The Trillion Dollar Thief' they're calling you," she sobs. "Is it—" she can't bring herself to ask, knowing I'll tell the truth no matter what. She bites her lower lip, at the same time brushing away a wisp of long gray hair with a graceful movement of her left hand. I've always admired her girlish shrug that follows, an unconscious but erotic motion that sets her long, long curls into sinuous movement. Once those locks were dark, dark red; now devoid of color, they mark her years—somewhere in the middle of the seventh decade of an eventful life. My own remaining skull covering, thin and sparse, matches that gray, year for earned year. I've kept hoping for the nano-medical revolution to come home, but so far the PacRimmers haven't dropped their prices enough that we can afford rejuvejobs, not on my retirement pay.

Joyce regains her composure and says, "Then it is true. What they're saying. You *did* deceive the whole world."

Shrugging, I nod. "You know it is true," I admit. Unsurprised, resigned, she sighs and returns inside to watch the rest of the claims against me, me the criminal Dreamer.

Outside, police sirens shriek, the warning calls of a suborned State, the wails of disappointed children. Angry children.

Dangerous children.

It began, unlike most stories, in the White House. Yeah, *that* one, the one that used to be where Pennsylvania Avenue used to be—where downtown Washington, New Columbia, used to be. Where the Bessarab Crater is, right next to the Mall Dome. Oh, excuse me—"The Martyr's Crater" is the Preferred Consensus, isn't it. I must have forgotten the most recent PC. *Which martyr?* I ask myself, thinking of the dozens of Secret Service, those thousands of Army troops who stayed behind while that physical coward of a President tried to run away to Camp David, getting swat-fried in midair for all his efforts. *Oh well, just one more secret from the Thought Police in the Land of the Semi-Free, Twenty-First Century version.*

Anyway, in those days a couple of speculative fiction writers wound up by pure chance assigned to the President's Science and Technology Office, technological consultants occupying adjacent desks in the Old Executive Office Building, which, though now a puddle of molten rust, was once a grand and glorious remnant of the Second Empire Style of

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architecture. (*Not* the Second Soviet, the Second *French—Napoleonic*. Look that up on the *verch* channels. Those New Reds have no more taste than their butcherous ancestors.) I was one of those consultants; the other, to remain unnamed until the neuroprobes do their nano-surgery, is now retired from the Joint Chiefs of Staff, and, I would wish, beyond suspicion and reproach. Until they mine my mind....

I smile at the memory of Dub. If only we had known where our idle speculations would wind up. I rather wish I had taken him up on that government job offer in one of the spook shops years later, but at the time the *verch* channel installations were under way and there was money to be made for creative sci-fi types.

"Dub," I said in all innocence, all those many years ago, "so what's with NASA these days?" He'd just returned from a briefing on the Mars Observer Mission from the space directorate, and was looking thoughtful. Glum, really. The new administration had recently canceled the Space Exploration Initiative, something Dub and his team had worked on for almost a year; their final report had recommended returning to the Moon and going on to Mars. But neither of those was ever going to happen, not in our lifetime. I would have thought a camera probe to Mars was the next best thing, but he was really P-O'ed at something.

"I don't understand those guys!" he snorted, slamming down the thin blue vinyl notepad. "I thought science—that's Science, with a Capital *S*—was supposed to be open, a free flow of information, all that easy access stuff." I nodded; something was really bugging him.

"But—?" I asked, prodding him on.

"But for some damned reason, those NASA bureaucrats have decided to encrypt all the data from the Mars Observer!"

I laughed, "What's the matter? They afraid of finding out the Face on Mars is *really* a face?" Dub flashed a meaningful look at me, as if he might have believed my off the wall comment.

He rolled out his swivel chair, plopped down into it, remained quiet for a full minute. Outside, the real national anthem of Washington, D.C.—the full-throated police siren—wailed past the Old Executive Office Building. The place had not been built to minimize noise—how much noise had there been from carriages and horses anyway? The muggy May afternoon reminded me that the magnificent building had been constructed long before air conditioning, too. Dub said, "Might be so, Arlan. Why else would they encode the stuff?"

I blurted out, "Boy, that would be something. We'd have a space program again, for sure." Somewhere in those next few milliseconds both our sci-fi minds zeroed in on the obvious solution: "What if—" we said simultaneously, then stopped, laughing.

"You can find out the encryption codes, Dub?" He nodded; as we had both discovered long ago, in the government business there are sci-fi fans

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and fans of space infiltrated simply everywhere, and their allegiances belong to higher concepts than petty bureaucratic rules.

"And, Arlan, you know the folks at JPL who will handle the data?" I nodded. We rolled our swivel chairs over to the center of the room and slapped a "high five." He swung around, opened a little-used lower drawer in his desk, pulled out a half-full bottle of some Scotch he'd brought back from an Air Force symposium in Scotland, years back. He poured an inch of the golden liquid in each of our empty coffee cups. We toasted ourselves, our future.

"To Space!" Dub said with a smile.

"Fuck the State!" I whispered.

Wasn't really that hard to do what had to get done, back there in the early '90s, even though our first attempt turned out rather poorly, at first. Folks didn't carry around Know-It-Alls to record every damned thing they did, or every conversation they had. No, not even criminals had to carry them—we didn't even *have* KIAs, you must recall they weren't even invented yet. So, anyhow, it was fairly easy to get committed, yet anonymous, people to do what was necessary to help the human race get into Space.

There was John at JPL, and Chuck at Orbital Corporation, and Kijo at NASA and Mike at NSA and Alyta out in Tucson with her multitude of friends of all ages, all over the scattered remnants of the fast-disappearing Space Program. And Dub's Air Force connections helped all along the line; those SSTO guys were anxious to have a mission before they were zeroed out of Congress' budget. With Harry out near the VLA and Ralph and Fred and Creve at Sandia, and the hacker FreeNet gangs at Bell Labs and Intel and BDM, why pretty soon we had the whole thing fairly well scoped out, coordinated and encrypted via the Internet link. We'd intercept the real Mars Observer data in real-time, erase it, overlay it with our own digitally-produced stuff, blow some minds, freak out the world, and get us all back on track, out toward the stars where we belonged.

Afraid of leaks? Why no, we weren't—we were all dedicated to The Dream, and any traitor would have been shunned forever, banned from The Dreamers, and that would have been punishment too severe to contemplate.

So that's what we did, our little-but-growing band of techno-conspirators: we diddled around with the data so that it would show The Face and The Pyramids and The City on Mars. This caused a bit of trouble, at first—our initial attempt to test our data-bait-and-switch accidentally screwed up the Mars Observer, and NASA lost a billion-dollar probe. We were all pretty bummed out for a while, but then the new "faster-better-cheaper" philosophy swung into play, and with Single-Stage-To-Everywhere rockets, a lot of probe stuff was soon en route to Mars. So we gave it to them, to the whole world—a reason to go.

On to Mars!

There really never was a problem;

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for twenty years now, I've worried about it, but there really never was a problem. No technical snafus, no traitors to The Dream. Hell, I tell myself, we gave them Mars. So it cost over Nine Hundred Billion dollars; that's about what it cost us to stabilize southern Africa, when they refused to pay up their share of the international Mars fleet. Mars is a lot prettier than the habitable parts of SwAfrikaa, and a lot more hospitable!

NASA helped too, of course. Not just the NASA Dreamers who went along with my deception, but the whole friggin' thing wouldn't have been possible without the government's paranoia, without them *encrypting* the Mars Observer video data, for God's sake! I mean, the Reds were out of business back then (at least in their first incarnations), so who were we trying to protect the data *from?*

So Mars Observer II (actually a half-dozen smaller, faster, cheaper ones) observed Mars in 1996, and we Dreamers, a lot more cautiously this time, diddled the data on every damned one of them.

With The Face and The Pyramids and The City beckoning Humynkind, We Went.

The first time was two years later, with a small fleet of miniature robot probes, the Purvises. Fixing all that surface-generated data proved a little bit trickier, but we Dreamers and our clandestine data diddling progressed as fast as Establishment Science did, so we were able to provide detailed photos—alien skulls, decayed machinery, tantalizing stuff that whetted the appetites of The Powers That Be. A couple of tragedies—one on the launch pad at White Sands, a tanker mishap—dimmed the glory, but we Dreamers sighed: *Pioneers are always at risk, but the Humyn race lives on!* We hadn't planned on the Afrikaan situation, nor the years of sacrifice that broke a couple of nations economically. (The U.S., for one.)

But today, twenty years after it all began, the USNA ships landed just hours before the NippHan fleet, weeks ahead of the ragtag SwAfrikaaners. Nine minutes after touchdown adjacent to the wind-sculpted, Sun-shadowed stone mountain that is "The Face," the fleet's video signals reached old Earth here, revealing the truth of Mars for all. (Yeah, I know, the video during the orbital approach kept showing the same old Face and City, etc.; some of us Dreamers kept the charade going up until the last minute.) I didn't watch the landing, feeling a mixture of joy for the event, a little sickness at my heart for having had to fool the whole world for two decades, trepidation over what the reaction would be, hopes for forgiveness.

Joyce had stayed on to watch them land on Mars, while I settled down in my easy chair on the back patio, waiting for the inevitable reporters, the outrage, finally, eventually, the respect for helping Humynkind achieve a true interplanetary civilization.

Hearing the first accusations, she had come outside to listen to my side; leaving me to return to the video set.

* * *

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The doorbell rings, followed seconds later by a loud banging on the door. Now Joyce is opening the front door, now she is speaking to someone, now the tromp and tread of the FedPolice echoes through the house. Now they are confronting me on the patio. I lift my beer and smile. Joyce is crying.

"Don't worry, hon," I say to her, acting more bravely than I feel. "One day they'll understand that I did it all for them." Paincuffs slither from one agent's hands and lock around my extended wrists. They hurt as much as advertised, but I grit my teeth and continue smiling.

Joyce shakes her head, a mixture of tired sadness and disgust. "No, hon," she whispers, "It's you who doesn't understand. Those men just told me. Your little plot hid the real truth from us all—The Face, The Pyramid, all of it—it's real!" I look at her, unbelieving.

One of the cops looks at me and nods. "It's true—you screwed up really bad!" I shrug. *So it's real, so we would have gone anyway. Big deal!* Her demeanor leaves me confused.

"You don't understand, hon," Joyce is saying. "I finally heard the whole thing, why they're so mad at you. The Galactic Community of Civilizations built those huge structures there just sixty years ago, when we—the Russians, I mean—launched the first satellites." I blink at her, not comprehending her meaning.

"They knew we were coming into space, so they got ready to admit us to their community. They have been waiting at The Face all these years, hoping for one of our probes to verify their presence, so they could establish communication. The first Mars Observer, the one you and your people screwed up, would have been the link—twenty years ago! And the data you did erase carried their messages." My heart is pounding furiously; I think I want to die.

The FedPolicePerson says solemnly, "You are charged with defrauding the human race of over nine hundred billion dollars for a space program that was obsolete before it was built—and you cost our world twenty years of Galactic Civilization!"

Joyce wipes away a tear. "We didn't have to wait, Arlan! The Galactics have light-speed ships, for God's sake! They have waited an extra twenty years for an invitation to come *here!*"

Overhead, the sky dims. Half the size of the sky, a graceful ship from heaven slips down from the clouds, angelic, awesome. ■

It is much easier to be critical than to be correct.

—Benjamin Disraeli

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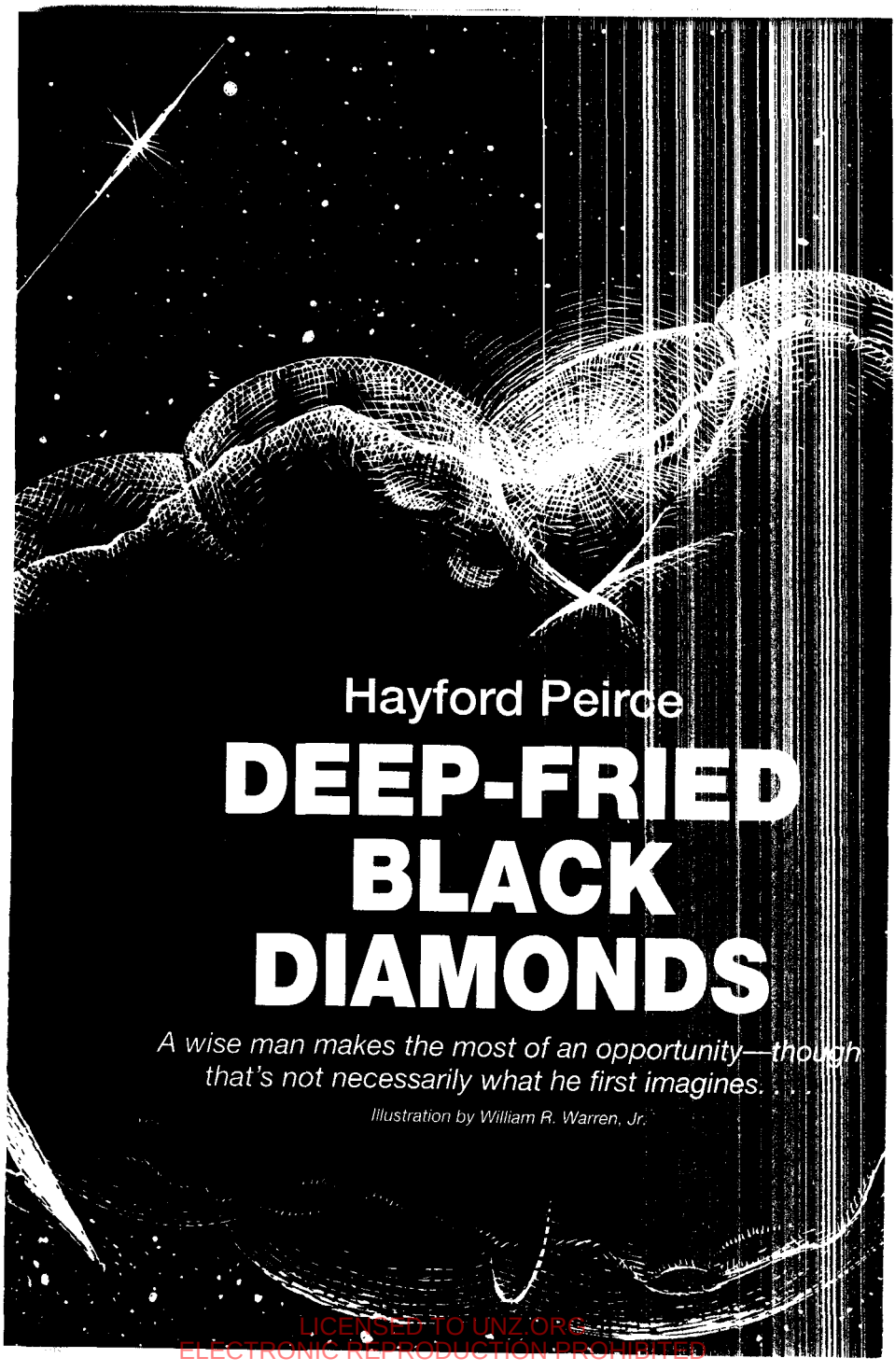

Hayford Peirce

DEEP-FRIED BLACK DIAMONDS

A wise man makes the most of an opportunity—though that's not necessarily what he first imagines. . . .

Illustration by William R. Warren, Jr.

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"What's a truffle?"

"You don't know what a *truffle* is?" Ling Wong Guoy looked at me in astonishment, then reached into his shoulderbag. He pulled out a wrinkled, prune-like object the size of a grapefruit. It was the color of an old black boot that has been worn by a nickel-iron miner in the far reaches of the Belt for twenty years or more without ever being polished. He set it gently on my desk, careful not to let it bounce in the nominal .04 gravity of Ceres. "Here, taste."

Now it was my turn to gape. "You want me to taste *that?*"

Ling Wong Guoy gestured at the miserable cubicle that Hartman, Bemis & Choupette laughingly called my office. "Would I come *here* to poison you? Would my kinswoman Jin Tshei *allow* me to poison you?"

Looking down at the strange black object on my desk, I actually considered his two ridiculous questions for a fleeting moment. Jin Tshei is my girlfriend's wife and—I thought—a close friend of mine. Could she finally have decided that she wanted Isabel all for herself, and this was her way of—

No, ridiculous! The very thought was unworthy of an Ethical Broker & Bourseman, particularly Jonathan Welbrook White! I picked up the repulsive looking thing and sniffed it tentatively. It had a pungent yet somehow elusive smell. "What do I do with it?"

"Take a bite, a *big* bite, just as if you were eating an apple. Let the morsel rest upon your tongue. Then chew it slowly, delicately, lovingly, savoring the flavors, letting the pieces roll around your mouth. Close your eyes. Let your entire being concentrate on nothing more than what is in your mouth."

I shook my head dubiously, then shrugged and did what he said.

Sometime later, when I regained a semblance of my senses, I opened my eyes to stare in wonder at what I held in my hand. I'm not a poet, so I won't try to tell you what it tasted like. All I'll say is that it was the most wonderful, most exotic, most sensual, most overwhelming experience I had ever had in my life. "Are you sure this is *legal?*" I whispered, then salivated noisily. It was all I could do to keep from stuffing the remainder of the truffle into my mouth as fast as I could push it in.

Ling Wong Guoy smiled knowingly. "Entirely legal, Mr. White. I use them frequently in my restaurant. You may have already tasted them there, in somewhat less overwhelming quantities. I have, I believe, already noted your distinguished presence in my humble establishment at various times."

Humble establishment—*that* was a laugh! Ling Wong Guoy was the owner and chef of the most elegant and most expensive restaurant in the entire Belt, La Voûte Céleste, an eating establishment so recherché that it actually employed human beings as waiters. Its name, it had been explained to me, was French for Heavenly Vault or Celestial Canopy. Since the restaurant was one of only seven buildings on the surface of Ceres and had an invisibly domed

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dining room open to the spectacle of a billion stars, its name was a meaningful one. I had eaten there twice; always, unfortunately, in the company of my unspeakable boss, J. Davis Alexander, as that worthy wined and dined super-important clients on the company expense account. I had never forgotten either meal.

"Truffles are those skinny little black things stuffed under the skin of the chicken?" I ventured, casting my mind and taste buds back to those two extraordinary feasts.

"Yes, truffle slices. And there are somewhat thicker pieces in the foie gras. On Earth the normal truffle weighs about two to three ounces at the very most. That truffle you hold in your hand would weigh about seventeen ounces, the result, I suppose, of growing it on Ceres in what is essentially zero gravity and in half the barometric pressure of Earth's."

I nodded slowly and took another voracious bite—after all, he hadn't asked for it back, had he? "It certainly is delicious," I said inadequately when I'd finished swallowing, "but why exactly have you brought this to *me?*"

"Do you know what a truffle costs per ounce in Paris or Périgord on Earth? Two hundred and seventy Belter buckles per ounce, Mr. White! I myself pay over 500 buckles per ounce for them to be landed on Ceres to use in my restaurant."

Once again I stared in astonishment at the dapper, black-haired little man on the other side of my desk. "You mean this thing here in my hand is worth over 8,000 *buckles?* And I've been *eating* it?"

"Yes indeed. Truffles are a form of fungus that grows underground at the roots of certain trees—generally the shrub oak—in only a few places on Earth, mostly certain regions of France and Italy. They are found by dogs or pigs that have been specially trained to sniff for them. They are generated from spores and for centuries now farmers and scientists have tried to find a way of cultivating them. So far no one has succeeded, although there is an experimental station in Spain that claims to have had some success. The entire world's production is no more than a hundred tons or so annually, which is why, Mr. White, their price is so outrageous."

I took another look at the half-eaten piece of fungus in my hand and then another look at Mr. Ling Wong Guoy, Restaurateur Extraordinaire.

Ling Wong Guoy was, I knew, an immigrant who'd come from Earth to Clarkeville, the fourth largest city on Ceres and the eighth largest in the Belt, about fifteen years ago. He'd started small, with a fast-food joint, and had worked his way up to La Voûte Céleste. I also knew that he was a kinsman of some sort of Jin Tshei, Isabel's wife, since Jin Tshei had told me so after I'd lunched at his restaurant for the first time.

Finally, I knew—like almost everyone else in Clarkeville—that Ling Wong Guoy was the owner of his own private asteroid, a tiny hunk of worthless rock that not even the most optimistic virophage miner had thought worthy of trying to extract anything from. Ling Wong Guoy had

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bubbled the entire asteroid—it was only a couple of hundred meters long—and turned it into a farm to supply his restaurant. Now the asteroid was famous throughout Ceres, and probably the entire Belt, for it was certainly the only one that raised pigs and chickens in order to supply a high-class French restaurant.

"You said that truffles only grow in a few choice places on Earth," I prompted the restaurateur. "You also said that this particular one—" now a bare smidgen of a memory of its formerly robust seventeen-ounce self "—was grown on Ceres. Does that mean—"

"Yes," said Ling Wong Guoy, "that means that I have succeeded where four centuries of Terran experts have failed. I have succeeded in growing truffles with no more difficulty than I have in cultivating mushrooms."

"How—?"

Ling Wong Guoy laid a finger alongside his nose. "Ahhh, *that,* Mr. White, is what I think I must call a proprietary secret. I will say this, however. A year ago I brought my cousin Hernández Wong Ling to Ceres from Earth in order to supervise my farm. Purely by happenstance, of course, my cousin just happened to have worked for several years on that experimental truffle farm in Spain I mentioned earlier. It may be—and I stress that this is only a possibility—that he *may* have inadvertently carried with him some of the spores necessary for their propagation. After that—" Ling Wong Guoy shrugged "—a rare combination of elements unique to that particular asteroid's soil, plus secret fertilizers and additives of our own, have enabled Hernández Wong Ling to grow this fabulous truffle which I guarantee you will grow nowhere else in the Belt. Or in the entire Solar System."

" 'A proprietary secret,' " I murmured, nodding slowly.

"Is that not the term used by certain companies, such as Coca-Cola, for products which they do not wish to register with the patent office? If there is no patent, as I understand it, then there is no need to ever reveal the exact composition of the product."

"Absolutely correct. But there's always the chance that someone else might use chemical analysis or reverse engineering to duplicate—"

"A chance that we shall have to take, Mr. White." Ling Wong Guoy's voice was firm.

"We? A chance in doing what?"

The outer Solar System's greatest chef leaned forward. "With enough capital for certain improvements on my little farm, Mr. White, we could soon be harvesting 2,000 truffles per month. Eventually, within three or four years at the most, we could increase that to 10,000 per month." He smiled blandly. "I will leave it to you to make the resulting calculations."

My ethical stockbroker's brain had already made them.

Truffles were selling for 270 buckles an ounce in Paris. And Ling Wong Guoy could produce seventeen-ounce ones, up to 10,000 a month of them! Even if he only netted 50 buckles an ounce after subtracting all of his costs and overhead, that would

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still be in the neighborhood of 20.4 to 102 million buckles net profit per year!

I didn't believe my brain. So I whispered the figures into my computer—and got the same results.

I stared at Ling Wong Guoy with ever-increasing awe. "That is a *lot* of money, Mr. Ling Wong Guoy."

"Yes. I have come to you to help me raise the necessary capital in order to begin generating it. Jin Tshei tells me that you, Mr. White, are without equal on Ceres when it comes to raising capital."

I gulped softly and apologized silently to Jin Tshei for ever having doubted her, even momentarily. "I do indeed have some ideas, sir. Why don't we just step over to the Café des Mondes to discuss them?"

That evening I met Isabel for drinks at the same table of the Café des Mondes at which I had sat with Ling Wong Guoy. I was hardly able to keep from bouncing up and down with excitement. Bouncing is something to be avoided in the low Cerean gravity: any bouncing here would have lifted me up against the café's green and white striped awning—and maybe on through it to interface violently with the ten meters of carbonaceous chondrite rock that separate Clarkeville from the surface. But even as a native-born Cerean with a lifetime's use of Velcro sandals, there are still plenty of bumps on my head to prove where I've given in to incautious impulses. So now I forced myself to sit quietly, impatiently watching the ducks in their pond in Westlake Park.

Isabel floated into the café with her usual grace, her feet hardly seeming to touch the pavement. She pecked at my cheek, then shook her glossy black bangs as she told the hovering waiter—a robot, of course—to bring her usual Pernod. I started to tell her about the incredible good fortune that was about to accrue to us, then stopped cold. Isabel's face was pale and drawn, and she looked as unhappy as I had ever seen her. She has a high-powered job in the assessor's office of City Hall, so naturally I assumed that something bad must have happened at work. But no.

"It's Valérie-France," she said grimly. "It's even worse than we imagined."

My heart sank, and I gripped my own glass of Campari and soda. Valérie-France was our four-year-old. "You mean—"

"Yes."

Four or five years ago Isabel and I had planned to get married and have a couple of children but Psych Service had turned us down. Isabel's latent attraction to other women, they said in their dogmatic way, made the chances of the two of us having a successful 23-year marriage something less than 25 percent. That assessment had come as a vast surprise to Isabel, who had always considered herself as straight as a mathematician's line, but who could argue with Psych Service?

If you want to have children on Ceres you have to be able to guarantee that there'll be a stable family environment until the child reaches his or her 22nd birthday. So, of course,

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once Psych Service had spoken there were no wedding bells for Jonathan and Isabel. We could have emigrated to some other world such as Pallas where the requirements aren't so strict, but we both had roots in Ceres. So Isabel married a lovely girl named Jin Tshei and they lived more or less happily ever after.

A little while after the marriage, I was invited to contribute the necessary genetic material for the creation of a little girl—the adorable Valérie-France, in fact. Now I dropped by for pleasant weekends with Isabel and Jin Tshei and my daughter two or three times a month.

Isabel forced a smile when her drink came and clinked her glass against mine. "You first," she said. "Bad news can always wait. Just why are you looking so incredibly radiant?"

I sighed. "I was looking forward to telling you that the moment had come when we're finally going to make our fortunes—legitimately. We're going to float Ling Wong Guoy a stock issue for a company specializing in truffles. Then we'll—"

"That's good, because we're going to *need* a fortune," interrupted Isabel. "Valérie-France is going to have to spend at least fourteen years on Earth! And she's going to need special medical care while she's there. We're not going to need a fortune, we're going to need *three* fortunes!"

"It's that bad?"

"Kesler's Syndrome. As bad a case as they've ever seen."

"But that's impossible," I protested. "Either you get it as soon as you're away from Maternity Rock—"

"—Or you don't get it at all." Isabel gulped a quarter of her glass of Pernod. "Except for the one person in 10,000 who *doesn't* develop it as an infant—and does later on."

"Oh," I said glumly. There were 9,781,549 people on Ceres as of that date, September 23, 2279, which meant that somewhere there were at least 978 others like Valérie-France around—not, of course, that that was any consolation.

In their fourth month of pregnancy, all the Belt's mothers-to-be remove to Maternity Rock, a 1.0-gravity facility in permanent orbit next to Pallas. If they don't, they're not allowed to bring the fetus to term. Every now and then you hear about a woman who manages to slip the medical surveillance network long enough to give birth outside the Rock. The consequences are not pretty for either mother or child and I don't like to think about them.

But even the perfectly normal children born on the Rock have to begin taking their gravity pills as soon as they leave at the age of one month. Otherwise they end up looking like my boss at Hartman, Bemis & Choupette—short, round, and rather fully covered with hair. His parents, who were religious fanatics of some sort or other, had stopped giving little J. Davis Alexander his pills as soon as he'd been taken home. His subsequent looks had not improved his disposition as an adult, as I knew from ample first-hand experience.

Not wanting Valérie-France to look like my esteemed boss, we had faith-

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fully given her the daily doses. All, apparently, for naught. According to Isabel, Kesler's Syndrome manifested itself, if at all, between the ages of three and five. For reasons unknown, the pills simply stopped working. We—Isabel, Jin Tshei, and I—now had a choice.

If we wanted Valérie-France to grow up short, round, and as hairy as a wolverine, with disposition to match, we could do nothing at all.

If we wanted her to grow up long and lean as a young man's dream—like most Belters are—we could send her to Earth and keep her there until her normal growth had stabilized, an age that was generally defined as being eighteen to nineteen.

Fourteen years on Earth. With full-time medical supervision. As Isabel said, it was going to cost a fortune. And if any of us wanted to visit her, as we surely would, it was going to cost three fortunes.

Fortunately, though, fortunes were right up my alley.

I lifted my glass to clink it against Isabel's. "Why should we pick an arbitrary figure like three fortunes? Why not say that I'm going to make us enough for *ten* fortunes?"

"Black diamonds," said Ling Wong Guoy, lovingly caressing a dirt-covered truffle he had just pulled up from his own home-brewed dirt. "That's what Brillat-Savarin called them, beautiful, beautiful black diamonds."

"Who's that guy?" demanded J. Davis Alexander with his usual suavity of manner.

"A nineteenth-century Frenchman who wrote a book called *The Physiology of Taste*. You might call him a philosopher of food."

"A philosopher. Huh!" J. Davis Alexander rolled his beady little eyes to show what he thought of philosophers. As I've already hinted, the branch manager of Hartman, Bemis & Choupette was short, globuloid, and hirsute. His disposition might charitably compared to that of a famished grizzly, except, of course, while toadying to his betters—anyone who had more buckles in their portfolios than he himself. His favorite sport was firing yours truly, Jonathan Welbrook White. It was a never-ending source of wonder to me—and to much of Clarkeville—that so unprepossessing a specimen of the human race could be happily married to Miss Grain Harvest of 2273, the tallest, slimmest, blondest, and flat-out most gorgeous female creature in the entire Belt. I guess it all goes to show that beauty really *is* only skin deep—or entirely in the eye of the beholder. Or something. Maybe it would take a French philosopher of taste to understand it.

Now J. Davis Alexander turned his baleful eye from the truffle in Ling Wong Guoy's hand to the man responsible for this horticultural miracle, Señor Hernández Wong Ling. The truffle expert was—compared to me, for instance—short, exceptionally broad in the shoulders, with a wizened brown face and soulful brown eyes. "You say that all of this can be turned into a truffle field." J. Davis Alexander gestured at the hundred yards or so of nondescript rock that was all that separated us from the ho-

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rizon and—literally—the edge of the world. "But can you guarantee it?"

Hernández Wong Ling shrugged mournfully. "Nothing in life, Señor, is certain except—"

"Yes, yes, spare me," muttered J. Davis Alexander, "death, taxes, and entropy. And a miserable death indeed if the bubble around this world ever broke. Has that ever happened?" he demanded harshly of Ling Wong Guoy, who was floating upside down just over his own hairy head.

"Never," said the restaurateur flatly. "Not even the smallest puncture or leak. Besides which, I have several emergency shelters and ample autonomous repair machinery. We would have to be blasted almost to dust by a full-scale meteorite in order to sustain life-threatening damage."

What he said made sense. Some of the new bubble materials are practically indestructible: light, flexible, shape-sustaining, and almost totally puncture-proof. There was serious talk that it was now feasible to bubble the entire world of Ceres itself and fill it with an atmosphere, a pleasant prospect for those of us who preferred not to live their entire lives underground.

"Hrmph," growled J. Davis Alexander, who seemed perversely determined to find some way of keeping me from making millions of Belter buckles. "All this capital you want us to raise for you—what are you going to do with it? Buy machinery to break up the rock and—"

Ling Wong Guoy looked at J. Davis Alexander as if he were crazy. "Certainly not! We'll use a standard agricultural virophage to convert the top two meters of rock into all-purpose soil, then start seeding it with our own special compounds." Here he laid a finger alongside his nose in a gesture that was becoming familiar to me and cocked his head slyly. "One thing we are going to have to do, Mr. Alexander, is to import and surreptitiously dispose of many hundreds of tons of completely worthless fertilizers, additives, manures, conditioners, and toners."

"Oh? Why's that?"

"Why, to keep anyone else from figuring out exactly how we grow our truffles. Let them waste their time and money investigating a thousand dead ends and wrong turnings."

"Ahhh." J. Davis Alexander blinked respectfully—this was the kind of double-dealing he understood. "Ha! Yes! Very good!" He rubbed his chubby hands together. "But what about the trees? How are you going to bring them in, and how long will they take to grow?"

"What trees?" asked Ling Wong Guoy innocently. "This is a farm, not a forestry station."

"The shrub oaks. I've been reading up about truffles. They're only found in conjunction with the roots of shrub oaks."

Ling Wong Guoy smiled broadly. "So it has always been assumed—but never proven. I will say only this, Mr. Alexander: shrub oaks and their roots are *not* needed—though perhaps we should plant some just in order to further confuse the issue."

"Ha!" More thinking along J. Davis

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Alexander-approved lines. "Well, then, Mr. Ling Wong Guoy, I think we shall have no trouble in floating your little issue. First we'll incorporate as Black Diamond Farm, issuing ourselves, shall we say, a million shares of stock at a nominal price of one-tenth of a centavo per share. Then we'll—"

"A moment," interrupted Ling Wong Guoy. "These million shares —just how will they be distributed?"

J. Davis Alexander beamed. "Normally on a highly speculative offering such as this, in which the good name of the underwriters, that is to say, Hartman, Bemis & Choupette, is all that matters for a successful offering, the underwriters would take 75 percent. In this particular case, however, in order to assist one of our most distinguished local citizens, Mr. Choupette has instructed me to tell you that we will be content with a mere 51 percent."

Ling Wong Guoy's black eyes grew opaque. "Ah! Fifty-one percent!" He scratched his chin. "Interesting, interesting. I believe that I should best consult again with Bleine, Blinder & Miesen on Pallas. I believe that one of their officers mentioned to me in passing that they would be happy to lead such an underwriting for 7.5 percent."

"What!" J. Davis Alexander's eyes grew round and apoplectic. Bleine, Blinder & Misen—the infamous Three Blind Mice of the stockbroking world—were our most bitter rivals. "Never would my conscience allow you to sully yourself by dealing with such disreputable. . . ."

Twenty minutes later the two purring cutthroats had agreed upon a split of two-thirds, one-third, the two-thirds going to Ling Wong Guoy. J. Davis Alexander was thoroughly vexed, of course, but what could he do? It was Ling Wong Guoy's truffles and nobody else's. If Hartman, Bemis & Choupette wanted to climb aboard the gravy train, they were going to have to do it on his terms.

"Well, then," said Ling Wong Guoy enthusiastically, rubbing his hands together in much the same manner that J. Davis Alexander had done earlier, "I think I'm going to enjoy this. We'll have public tastings all through the Belt. We'll give away a thousand kilograms of free truffles, along with recipes. I'll go on television to show how to cook them, how to savor them, how to—"

"Ahem," I interrupted. "I, too, have been reading up on the history of truffles. Some authorities have claimed that they're also aphrodisiacs."

"Is that *true?*" demanded J. Davis Alexander, his eyes glittering.

"Who knows? Unless you're Mr. Ling Wong Guoy here, who could possibly afford to eat enough of them to find out? Not that I need any for myself," I added modestly, "but I don't think it would hurt to mention the possibility when we float the issue. . . ."

"How much are we worth today?" asked Jin Tshei seven months later.

"On computer? The three of us? About four and a half million buckles."

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Jin Tshei shook her head wonderingly. She is taller than Isabel, and not quite as rounded in the places that I myself find particularly interesting. She has golden skin the color of honey and glossy black hair that falls nearly to her waist. If J. Davis Alexander's wife, Miss Grain Harvest of 2273, is the most flat-out gorgeous creature in the Belt, then Jin Tshei is a close runner-up. Sometimes I envied Isabel the fact that she was married to this beautiful woman and I wasn't, but mostly I managed to suppress the thought. Jin Tshei is the assistant curator at the Clarkeville Museum of Art and Human Achievement and normally displays little interest in monetary matters except as how they relate to acquisitions for her rapidly expanding museum. "Four and a half million buckles," she repeated softly. "I just can't believe it. Are you sure you're right?"

I nodded smugly and broadened my smile to encompass Isabel, who was sitting between us at the dining-room table. The three of us were finishing up a pleasant Sunday afternoon spent together at their apartment just on the outer edge of Silverspur, Clarkeville's most desirable residential area, and I was about to leave for an early night in preparation for another arduous day in the life of an ethical stockbroker. "I know it seems unbelievable," I said, "but it really is true. There's never been an issue in the entire Belt that's been snapped up so fast. It doubled as soon as it hit the market, and then doubled again—all in the first day. Since then it's doubled and split seven times. It's now the company with the highest market capitalization in the entire Belt."

Isabel pursed her lips thoughtfully. "You mean that if you sold all the outstanding shares, they would be worth more money than Magnus Mining or Solar Transport Systems? But that's insane!"

I shrugged. "Insane but true. J. Davis Alexander thinks that at least some of the money is coming from governments on Earth, France, Italy, and Spain, that are trying to protect their truffle farmers by buying up as much stock as they can—and then eventually trying to suppress the company."

"Do you think that's true?" asked Jin Tshei.

"I don't know—but we've advised Ling Wong Guoy to put a permanent fleet of gunboats around Black Diamond Farm. That's now the single most valuable piece of real estate in the entire Belt."

"All without a single truffle being produced except for the ones he already had growing," marveled Isabel. She turned her eyes to mine and they were far from being uncritically admiring. "I remember some of the other financial escapades you've involved us in that were going to make our fortunes. It's my understanding that all of this enormous fortune you've accumulated for us on computer is actually based on us having bought stock on margin?"

"Of course," I said. "How else could we possibly accumulate enough to be worth this much, no matter how often it doubled? I got a

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little bit of the original one million shares that was privately issued and split it between us, then when the ten million public shares came out I bought as many as I could on margin." Margin is money that a stockbroking firm such as Hartman, Bemis & Choupette will lend its customers to buy stock on credit, the loan being secured by keeping physical possession of the stock itself. It's an easy way to make money—as long as the price of your stock keeps going up. If the price goes *down*—well, that's another story.

"And as our net worth goes up, that's enabled you to make more and more purchases on margin?"

"That's right. Why? Do you think I haven't been buying enough?"

Isabel and Jin Tshei scowled at me simultaneously. It was like watching a simultaneous eclipse of a double sun. "That is not at *all* what Isabel means, Jonathan White," said Jin Tshei testily. "What she means is that in all these wonderful months of making millions of buckles for us, you seem to have forgotten that the whole point of the exercise was to make enough money to pay for Valérie-France's stay on Earth and for an annual trip by each of us to go visit her."

"Well," I said, somewhat irritated, "isn't that exactly what I've done? In another month or so, when the stock has doubled again, we can all go to Earth and live in a castle for the rest of our lives."

Isabel shook her head. "We've heard your prognostications of the stock market before—and none of us are millionaires as a result. The essential thing here is Valérie-France's health. According to my own figures, we're going to need two and a quarter million buckles to pay for her stay and our visits over the next fourteen years. That's if we buy a guaranteed annuity."

I groaned in disbelief. "Throw away millions of buckles by investing them in annuities? When we can easily make—"

"Jonathan," said Jin Tshei, "you're outvoted. Put through the sell order for two and a quarter million first thing in the morning. According to you, that still leaves another two and a quarter million. A third of that is yours. You can do whatever you want with it. Isabel and I are going to take ours and buy two more annuities with it—fourteen years pass pretty quickly, you know. One of these days Valérie-France is going to be ready for college and then graduate work. How did you think we were going to pay for that?"

I shook my head in despair at the sheer folly of the words that issued from the mouths of these two beautiful women. "Madness," I muttered, "utter madness."

Jin Tshei stood by my side as we watched Ling Wong Guoy supervise the final loading of a full ton of carefully selected truffles onto the Solar Transport Systems ship that would take them to Earth. A billion stars or so, even more than were visible in the dining room of La Voûte Céleste, stretched from one end of the Cerean horizon to the other. It was a sight that always took my breath away. One

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of those distant lights, I supposed, could easily be Earth.

The master chef and restaurateur turned away from the cargo hatch. His face brightened at the sight of his beautiful kinswoman. "So kind of you to come to say goodbye," he said, taking her hands in his and showing no great hurry to release them.

"This is your moment of triumph," said Jin Tshei, nodding at the video cameras that surrounded us. "We wanted to see it in person. And to tell you to give Isabel a big kiss from both of us. You're sure you'll be seeing her?"

"Of course. She has already agreed to come from Switzerland to attend our little soirée. I will naturally be too busy during the dinner itself to entertain her, but I shall see her before and after. And I shall arrange that she sit between two of the most interesting people there, perhaps the King and Queen of the Netherlands."

While gracious of Ling Wong Guoy to make the offer, I thought that this was rather unlikely. His so-called "little soirée" was a nine-course, black-tie dinner for the 250 greatest gastronomic figures in the Solar System: chefs, restaurant owners, food critics, media types, and a scattering of royalty. Most of them were French, of course, but because of the bitterness evinced by the local truffle growers, it had proven impossible to organize the dinner in either France or Italy. The neighboring Kingdom of Bohemia, however, also turned out to be a gastronomic powerhouse—and had no angry out-of-work truffle seekers to throw rocks at innocent diners. So it was to a princeling's palace in Prague that Ling Wong Guoy was delivering his ton of truffles for what promised to be the most celebrated—and best—dinner in culinary annals.

And even if she wasn't seated between a king and queen, at least Isabel would be there. This was the second trip she had made to Earth this year—the first had been to establish Valérie-France in her general-purpose school-home-medical center in the Swiss Alps—and she would stay another two weeks before returning to Ceres. So it was easy enough for her to slip across a couple of borders to attend a dinner that thousands of the rich and beautiful and socially connected had already been turned away from.

"It's awfully kind of you to have invited her at all," I said.

"It was the least I could do, after all that you have done for me and Black Diamond Farm. After this dinner, our BDF truffles will be famous throughout the Solar System. And when I return, I promise that I will cook exactly the same dinner for you and that delightful partner of yours, Mr. Alexander."

Tyrannical boss was a far more apt description, but I merely smiled. "At least we'll be able to watch the vidcast of the dinner," I said. That was true. The dinner was going to be telecast in real time all over the Earth; Jin Tshei and I would be able to watch it a few hours later after the tight-beamed transmission had made its way across the 3.8 AUs that presently separated Earth from the far side of

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the Asteroid Belt.

"That is true," agreed Ling Wong Guoy. He glanced up at the nearest video cameras, moved Jin Tshei into a slightly more photogenic angle, and stood on tiptoe to kiss her gallantly on both cheeks. My own cheeks received the same treatment in a far more perfunctory manner, and then the celebrated restaurateur was marching as if to martial music to the entrance of the ship that would take him to Earth and his glorious destiny.

"I wish we were going too," sighed Jin Tshei. "I do miss Isabel. And Valérie-France."

"Me too," I said. "I also wish the two of you had listened to me." I gestured at the media people that were still gathered around the entrance to the ship. "The publicity for this dinner is already enormous—and has only gotten started. The price of BDF was up another 27 percent this morning. By the time those 250 greedy guts in Prague actually take their first bite of poached truffle, it figures to have doubled again. If you and Isabel hadn't put all your money into those damned annuities, you'd each be worth another two million buckles."

"Just like you are."

"Yes," I agreed, "just like I am."

"Turn on your television to the Earth news!" shrieked J. Davis Alexander's hysterical voice from his corner office overlooking the duck pond in Westlake Park. "Go back four minutes!"

Heart pounding with sudden apprehension, I switched on the screen. All I saw was a milling mass of people in archaic clothing. "Back four minutes!" I snapped.

The image broadened to become a panoramic view of an opulent ballroom. Thousands of candles in crystal chandeliers glittered upon gold and silver fittings. Long white tables stretched across the room. The tables were packed by men in black suits and women in colorful gowns. Somberly dressed waiters swept silently through the aisles. My heart pounded even faster as I recognized the scene: it could only be Ling Wong Guoy's *Diner des Diamants Noirs.*

But what the devil was it doing on the headline news channel instead of on Arts and Graces III, where it was scheduled to be shown in its entirety about six hours from now?

"Sound," I told the set, "give me medium sound."

"—About ready to serve the second course," came an unctuous whisper as ripe and plummy as an entire orchard of damsons. What now appeared on the screen was a medium close-up of a distinguished old gentleman with a flowing white beard and a chestful of colorful decorations. His eyes glittered and the tip of a pink tongue moved back and forth across his lips as he impatiently awaited the next course.

An arm appeared and placed before the old gentleman an elaborately wrought golden soup dish. In the dish sat a shiny black truffle.

"This," said the plummy whisper, "may well be the highlight of the entire feast, a dish that has utterly vanished from the menus of the world's restaurants for more than a century

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now: *Son Majesté le Diamant Noir Mijoté à Ma Façon dans le Roederer Cristal 2258.* That is to say, an entire truffle for each guest, simmered in Mr. Ling Wong Guoy's manner, first in butter and shallots, then poached and briefly baked in a champagne whose very name and vintage move connoisseurs to tears. As you can see, the waiter is now ladling a generous portion of *demi-glace* sauce over the truffle. And now, as a further and final embellishment, he is sprinkling it with a few glittering petals of crystallized violets."

The commentator sighed rapturously. "Let us watch now as Commander von Brutenberg, *Chevalier des Tâte-Vins de Bordeaux,* takes his first bite of this almost ethereal truffle. The Commander savors the extraordinary aroma and bouquet; with trembling hands he slices an initial morsel; eyes closed in reverential awe, he lifts it toward his mouth. His mouth opens, he—"

The grapefruit-sized truffle sitting in the solid gold soup dish exploded.

For a long, long moment it was impossible to tell what had happened. When the jumbled images on the screen cleared, it was to reveal Commander von Brutenberg thrown back in his chair, his face and torso covered with a thick black paste that dripped slowly to the floor as he attempted to wipe the hideous goo from his eyes.

Now there came a sharp rattle of popping sounds as one after another the other truffles began to explode. The last I saw before my horrified eyes refused to look any longer was hundreds of screaming guests leaping and thrashing in a lemming-like panic to escape the culinary bombs.

I was still immobilized with shock when the face of J. Davis Alexander appeared around the corner of my door. I had an instant premonition of at least a portion of the monologue to come.

"The price of BDF has just dropped 98 percent! Trading has been suspended on every exchange in the Solar System! Ling Wong Guoy is in the hospital after trying to kill himself by slashing his throat with a truffle parer! He'll be all right, curse his incompetence!—it seems you can't do much damage with a paring knife—but there was lots of blood all over everything, just perfect for the TV cameras!"

J. Davis Alexander's voice sank to a barely audible growl. "Old man Choupette himself called to say that any imbecile in the firm dumb enough to have bought any of this stock on margin has to cover it at *once!* That's me, White, *me!* Thanks to you and your lunatic ideas, I'm a ruined man!" J. Davis Alexander's eyes bulged with rage. "White," he screamed, "you're fired!"

That was the premonition I'd had.

It's no fun being a prophet in your own country.

Isabel looked as beautiful as ever upon her return from Earth—no, more beautiful, for she had a glowing tan of the sort that you can only get in the expensive air of the Swiss Alps. But she was Jin Tshei's wife, after all, so I faded discreetly away for a day

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or so to allow them their own homecoming celebration. Finally, when it was my turn to celebrate, I invited the two of them out to dinner.

"I'm afraid that this is all I can afford," I said apologetically.

Isabel and Jin Tshei glanced around at the stark rock walls of the fast-food emporium. We were deep in the bowels of the southwest corridors of what is generally called Minerstown. Faded posters of the Mediterranean Sea and other Earth scenes made a half-hearted attempt to alleviate the sense of being buried hundreds of meters below the surface. "Looks OK to me," Isabel shrugged. "Anyway, we've all of us been poor before."

"Never as poor as *this,*" I groaned. "I'm ruined, just like J. Davis Alexander says he is, but *really* ruined. Everything I owned I'd put into margin on BDF. All I've got left is my commissions—and the reputation of being the guy responsible for the biggest stock market fiasco in seventy years."

Isabel leaned across the table to brush her lips against my cheek. "It doesn't matter, darling, we love you anyway, don't we, Jin Tshei? And so does Valérie-France. Jin Tshei and I will pay for your ticket to visit her at the end of the year, just in time for Christmas in the snow—that'll be jolly for both of you."

"Jolly, yes." I stared at her glumly. "But what I *still* don't understand is what made those damned truffles go off like hydrogen bombs! Everyone here is talking about the barometric pressure differential and the—"

Isabel looked at me wide-eyed. "You mean you don't *know?* I heard it in the *strictest* confidence from the first officer on the ship home. A charming fellow, very tall, very handsome, very, *very* French."

"I can just imagine," I managed from between clenched teeth. "And just what did this ever so handsome Frenchman tell you in the strictest confidence?"

Isabel's laughter was a light tinkle. "Oh, that the French secret service sabotaged the dinner, of course, just as you were afraid that they might try to attack Ling Wong Guoy's asteroid."

"What! But *how?*"

"Remember when at the very last moment they sprinkled crystallized violet petals over the truffles?"

"How could I ever forget?"

"What country do you suppose is the only supplier of crystallized violet petals in the entire Solar System?"

"France, I suppose?"

"Exactly. And every one of those beautiful translucent petals was loaded with dozens of tiny little capsules of some chemical like sodium peroxide, only more so."

I frankly gaped. "You mean—"

Isabel nodded. "They were perfectly harmless as long as they were dry. But as soon as the waiters poured the sauce over the truffles and then spooned the violet petals into the sauce the capsule coating began to dissolve. And then when the chemical encountered the sauce—" Isabel puffed out her cheeks "—*kablooey!* No more truffles—and no more truffle market!"

"And no more money for Jonathan," I said sadly.

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"I'm sure you'll think of *something* to restore your fortunes, darling. At least you got your job back with that swine Alexander." Isabel looked up with suddenly glowing eyes. "My goodness, this is certainly a delicious cheeseburger! It even tastes like real meat!"

"That's because it is. Wait till you taste the fries." I pushed some in her direction.

"The fries? These black things are *french* fries?"

"Sort of. Go ahead, have some."

Isabel inserted a black strip of french fry into her mouth, chewed, and rolled her eyes in ecstasy. "I've never *tasted* anything so good! What on Ceres is it?"

"Deep-fried truffle, of course. What else do you think Ling Wong Guoy can do with the two tons of truffles that Hernández Wong Ling is harvesting out on his asteroid every month? He can't sell them on Earth, and the price has collapsed here on Ceres—they're cheaper than potatoes."

Isabel stared at her plate in astonishment. "French-fried *truffles?* And that's *Ling Wong Guoy* out there in the kitchen?" She gestured at a white-hatted figure dimly visible behind a battery of stainless steel implements.

I nodded. "He says no one in the Solar System will ever think of looking for him in a hamburger joint."

"But that's *terrible!*"

"Except for the people in Clarkeville who like the vegetarian special."

"The vegetarian special?" Isabel wadded a great handful of fries into her mouth.

"Sure." I pointed to the sign on the wall. "Deep-Fried Black Diamonds—that's what he calls the vegetarian special. See those two guys over there with the really idiotic expressions on their faces? The skinny one's the head cook at the Tour d'Argent in Paris and the fat one's the owner. They've been here three times a day for the last two weeks *eating nothing but the vegetarian* special. And they're not the only greedy guts who have come all the way from Earth just to eat them—the town's *full* of them."

I popped a deep-fried black diamond or two into my own mouth. "Even though he's bankrupted me, I do have to admit it: Ling Wong Guoy is one classy sort of guy." ■

Example is not only the best way of propagating an opinion, but it is the only way worth taking into account.

—Samuel Butler

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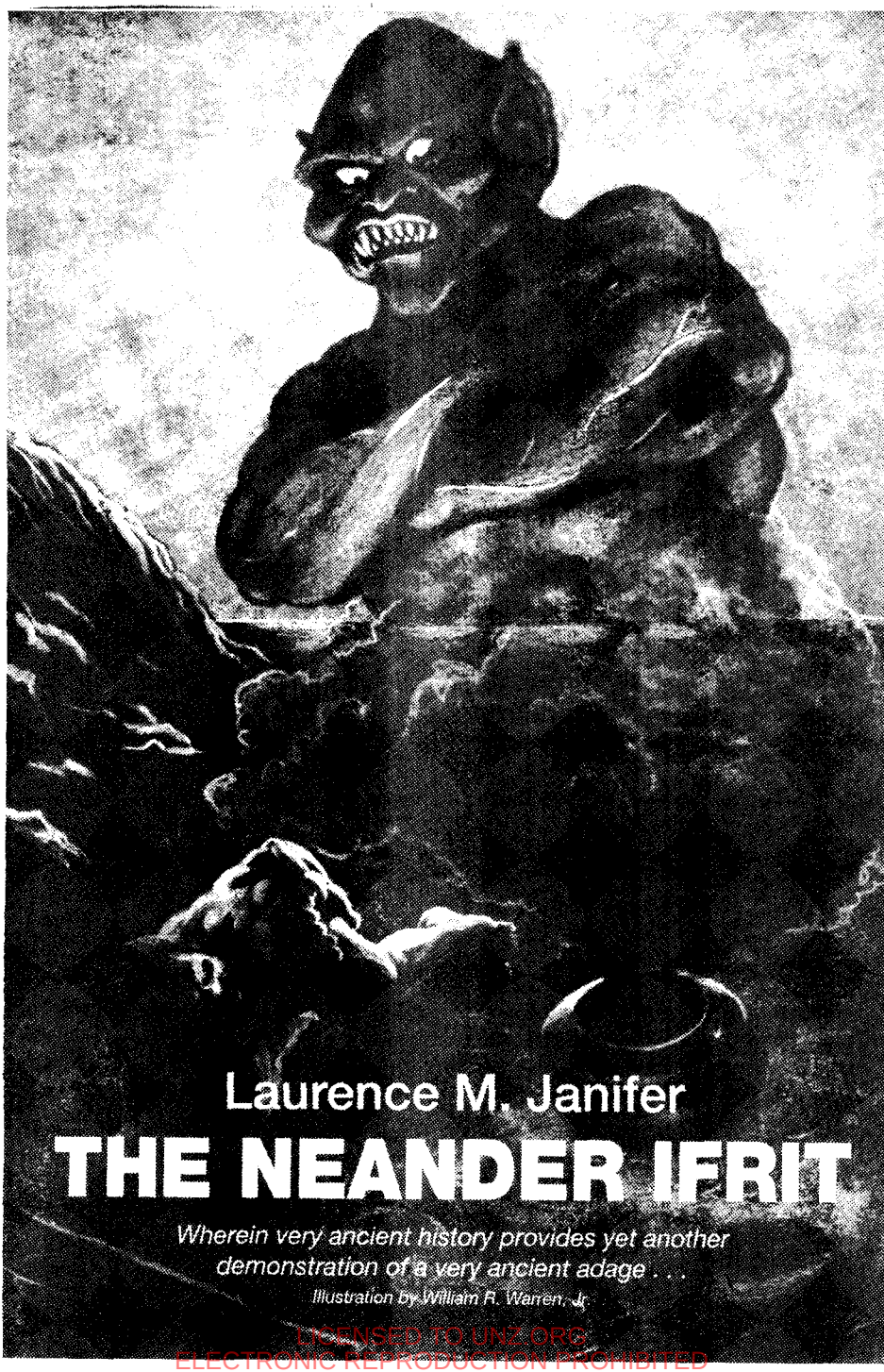

Laurence M. Janifer

THE NEANDER IFRIT

Wherein very ancient history provides yet another demonstration of a very ancient adage . . .

Illustration by William R. Warren, Jr.

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Dear Stan:

This may be a long sort of letter, so sit back.

New York (to start where everything starts) is a very strange place, and commuters like you never really get to know it. The place has everything, including a pile of stories that are flatly unbelievable; if I told you about Little North Evans Boulevard, for instance, you'd accuse me of inventing the whole thing, and there are even people who refuse to believe that there is a spot in Manhattan where Waverly Place crosses Waverly Place and goes charging off in all directions, as the man said—and they can see that one for themselves. All you have to do is find Sixth Avenue (which is easier to do if you remember not to call it Avenue of the Americas) and where it crosses Waverly Place walk west along Waverly, and when you come to the old Infirmary you're there. The sight left a permanent neurosis in an old friend of mine, I'm afraid, who happened across it one very drunken night.

And of course the town has a positive farrago of Institutions of Learning, from Columbia and Pace and God knows what-all to, say, the State University of New York (SUNY) and the City University of New York (CUNY), the whole rickety pile of them teaching God knows what to God knows how many eager young minds. There's one more institution, I find—whose computer is really responsible for this letter, I suppose. I've just run into the Local University of New York (LUNY).

LUNY is a private university—very private. They don't want any sort of government funds, being a little afraid that the government would then jump in and tell them what to do, which textbooks to use, and so on; as it is, they may be the only university anywhere that uses *Alice's Adventures in Wonderland* and *Through the Looking-Glass* as primary math texts, and Gordy Dickson's *Dorsai* novels as basic sociology. They want no interference, and my guess is that, if government were allowed in, they'd have some.

LUNY has a lot of ties to science-fiction, come to think of it, not the least of which is that the place *sounds* like science-fiction. They've only been open twelve years so far, but some of their early graduates have already found places for themselves in private industry; that plan to bury people in space and sell advertising linage on their coffins, if I have it right, was a LUNY project.

And, as I say, it's their computer that is at the root of all this. I ran into it because I was fiddling with an amok-computer story, and ran into a very full professor at an Italian place over here on the Medium West Side (I think New York may have more Italian restaurants than Florence, though I am certainly not going to go there and check), and he talked things over with me the next day in his offices, inside the LUNY Main Building. (By the way—they're keeping the computer sort of quiet so far, and I hope this letter doesn't injure that privacy any—but what the hell, it's just between the two of us, right?)

Part of the computer—what they

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call the interactive array—is named Daisy (because the name occurs in "A Bicycle Built for Two", though it is not, damn it, the name of the bicycle), since the computer is built around the idea of two full cycles. That is, every operation goes through two cycles, with a third cycle (which the computer-lab people here have christened the Training Wheels) on call in case of disagreement.

Yes, I know: nearly all computers have an I-tell-you-three-times system, more or less. This is something else. Every operation goes through *two* such triple plays, and maybe a third, with each individual sheaf of commands checked at interruption points. It slows things down some, though not as much as you'd think because some radically new notions are a part of the configuration, but it does, they tell me, give added assurance and added power somehow or other.

The computer as a whole doesn't seem to have a name, and so far has refused to accept one. Whether or not the thing is alive or conscious has been the subject of several ongoing LUNY investigations, and two honors courses, and I'll keep you posted. But it is certainly the damnedest thing of its kind I have ever run across.

It keeps reminding me of a phrase from one of those novels Fred Pohl and Cyril Kornbluth wrote back in the Peculiar Old Days—the one set in a low-calorie society (which is an exact description) and involving a heroic group called Sons of the Wolf, which I assume was their way of getting Sons of Bitches past what censorship then existed.

This low-calorie society was full of people who meditated, and the prize form of meditation was "meditation on connectivity." This made a certain amount of sense in the novel, and it makes much more sense if applied to the LUNY computer, because Connectivity, so to speak, is most of its business.

It's set up to connect every fact it's ever been fed with every *other* fact it's ever been fed, which makes for a total number of connections that staggers the mind. Anyhow, it staggers mine, though as I grow older I find I stagger more easily. There did come a point at which the sheer number of discrete connections started the computer *losing* information (go see a topologist if you don't believe me; what do you think I'm doing, making stuff up here?), but by treating the information in ad hoc bunches for purposes of preliminary definable connection they got things back into what they apparently think of as line. And as the LUNY staff has fed the computer every datum a wildly assorted staff could get its hands on (including fiction—so labeled—music, paintings and sculptures as encoded systems, and dictionaries in 170 languages, give or take a dialect) it is making a very great many connections by now.

Their idea is, of course, that material in one area can contribute to work in a whole different area—not exactly a novel notion, but they're leaning on it a little. I asked my tame professor for an example, and he said that material common to the manu-

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facture of shatterproof glass, the understanding of cattle stampedes, and some oddities involving fractured spines in camels is about to make a breakthrough in that grey area between the quantum-physics world and the Newtonian world in which all of us used to live so happily. I'll write you more about that when I understand it a little better. But the report for the moment starts with all those dictionaries the thing has digested.

It seems (according to the computer) that all known languages do have a few big things in common, though some languages have tried to eradicate these ancient influences. The fact that German has no nonsense words (I mean no deliberate nonsense words), says Daisy, is evidence that German is one such language. Don't ask *me,* for heaven's sake.

I actually talked to Daisy, of course—the interactive array—in her office, down in a sub-basement of the Main Building. (Incidentally, *everything* is in the Main Building, because LUNY only has the one building, though it is a large one; it was named after a Charles Freidrich Main, and if I ever find out who he is or was I'll tell you.) Daisy insists that there are common sub-roots in all languages, that provide a sort of Rosetta Stone not only for written language in general but—and very specifically—for hieroglyphic writing and picture-writing in particular.

In fact, Daisy says, she has examined all the seven-hundred-odd cave paintings available for remote examination, and she claims that they are a form of language, a neat oxymoron: a written prehistory.

There are (Daisy says) five possible positions for each leg, including "invisible or not drawn," six possible positions for the head, and so on, and combinations allow for a great many "basic roots" for words or even, in a way, sentences. Most of the possible positions do turn up in what are labeled later on, as a couple of positions began to be used as "shorthand" for longer but very common expressions.

When all this is to be made public I do not know, but Daisy and LUNY do seem to be on to something here. There is a real prehistory, apparently, that can be read—and some of it, I am very much afraid, doesn't look like anything in the least plausible. Von Daniken, an entire endless Philip Glass score full of New Age vapors, and eleven Luddites a-leaping, all put together, look a great deal more plausible than some of this stuff does.

One story in particular. . . .

It seems there was this cave man.

As a matter of fact, it does. He was a Neanderthal fellow, all aspirations and no forrid if you remember the limerick, and one afternoon by the shore of whatever sea it was that he was near, he stubbed one of his hairy toes on a Thing.

(I can't tell you what sea he was near, or where the hell this all happened; the cave-painters and Daisy and I don't share anything resembling a coordinate system. Neanderthals are named for the Neander Valley, but

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they might turn up almost anywhere even remotely plausible, and I'd rather like it to be the Arabian Gulf, and what the hell, it was the Arabian Gulf.)

The thing was a large "extended circle"—apparently some sort of vaguely cylindrical form—made of something harder than seashell. It didn't break when the cave fellow tried to wrestle with it, and it didn't bend either.

He seems to have spent some time and some energy on it, either because he thought it would make a good dish, weapon or hat, or because curiosity was alive in the caves, which seems a lot more plausible. (Oh, let's give this fellow a name. In the records, he doesn't have one, so we're entirely free to christen him as we please. How does Dave sound?)

Standing or squatting there by the shore of the Arabian Gulf with this Thing in his hands, he finally tried the right set of motions, and there was a hell of a cloud of smoke, and an even larger and more dangerous-looking Thing appeared.

It was, say the records, nine feet tall (roughly "twice me" for a Neanderthal), comparatively hairless, and possessed of that sort of menacing mien which doesn't bother to boast or crow or threaten because it *knows* it is better than you are.

Remember that Dave had a language, at least "on paper" or "on cave," and therefore, almost certainly, existing as sound too. Language seems to be innate among human beings anyhow, and when we go to the animal experiments... but let's not. Let's just remember that he had a language—which enabled this nine-foot-tall Thing to communicate with him.

It said it was an Ifrit. It said it was older than humanity ("humanity" at the time being Neanderthal, but let's not quibble; if the Ifrit didn't, and was there at the time, what standing have we?), and had been cursed into humanity's service.

This did not make a lot of sense to Dave. None of it, from "older" to "cursed." "Humanity's service" made a little sense, maybe—the Thing was offering to become his slave.

It was an exceptionally tall and powerful-looking Thing, and as a slave it would be beyond price, so to speak. Dave was, of course, a little suspicious, AKA just plain scared; in his experience big powerful-looking Things, human or otherwise, did not rush up to you with heartfelt offers to serve you; nor is it any different today ("I'm from the Government and I'm here to help you").

But after a little wrangling, things began to become clearer. A great Mage of some sort (and you can translate "Mage" as anything from "Shaman" to "Ancestor Ghost") had laid a curse—a set of orders unpleasant to the recipient that could not be disobeyed. These orders involved fulfilling three demands made by any human being who got him out of his container.

You might at this point go and look up "Ifrit" somewhere. A dictionary might do for that, and a dictionary of mythology certainly will. I'll wait.

OK? Stan, I want to tell you as

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clearly as I can that *I am not responsible for this; I am describing translations received of cave paintings by a computer.* Things cannot possibly be more scientific.

So this genie offered Dave three wishes.

Dave, once he got the idea, did not hesitate very long. The first wish he made, the records say, was for a fresh haunch of meat, big enough to feed Dave and his family for a long time (your guess is as good as mine, but it had to be small enough for Dave to lug from the shore back to wherever nearby this particular cave man was living, so "three or four days" looks about right when we remember that there were at least two others in Dave's family—wife and son—and possibly more). No trouble, says the genie, just wait a second or two, and he snaps his fingers (or whatever it is he does; the translation is anything but specific on this point, and I am not an Ifrit expert—and try saying "Ifrit expert" three times with your mind full of Scotch) and there is the haunch of meat.

Dave gives a cry of joy and starts off with it, and is called back by the genie, who wants to know about the other two wishes. He asked Dave, it seems, if so small a thing as a single set of good meals is all he wants.

It doesn't seem so small a thing to Dave, of course, but genies don't miss meals and have no idea how important the one you didn't get comes to be. All the same, Dave thinks things over.

He would like, he says, to be invulnerable to other cave people and large animals. Is there something that would ward off hurt no matter how big and strong the threatening Thing might be?

(This may in fact have been Dave's high reach for sheer cleverness; could he get the genie to make him invulnerable to the genie?)

Sure and I'll do that, says the genie, and r'ars back and makes some passes in the air (or whatever it is he does), and there is an occult flash of light and the genie says: "There you are, now. Diseases, hunger and the thousand natural shocks will still do you in, singly or in battalions, but your specifications have been carefully observed; manufacturer is not responsible for defects due to sheer inadvertence."

And it's the genie who suggests they test the new spell, though Dave is a bit reluctant; maybe this has all been a setup so that the genie could kill him and laugh at his stupidity. But at last he is willing that the genie swing at him, and the genie's fist bounces off and the genie makes a most convincing *owoo* sound and Dave feels invulnerable, and deserving of it, too, for did he not expose himself to awful pain from the genie's fist just to test it?

And the genie stops Dave as he is again about to run off, and asks about the third wish. And Dave wonders about the biggest things in his world. And he wonders, and he wonders.

And finally he makes his wish.

He is a family man, after all. And among the Neanderthals he has known there are leaders, and leaders-

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of-leaders, and once, a long dim time ago, he has heard of a leader-of-leaders-of-leaders.

His son might become such a one. Dave knows that he himself does not have the Right Stuff; he fears things, and one can see from the way leaders act, after all, that they fear nothing whatever. But his son is still sort of new, and changes might be made.

Says Dave: My son shall be the leader of all leaders-of-leaders-of-leaders and shall rule over all humanity, and his seed after him, as long as humanity shall exist.

And says the genie: It is so, and it is done. That is a wish of some size, and I do not mind saying that its fulfillment cost me no little exertion and indeed a fair amount of eldritch cunning; but it is done, and you shall be content. And now, says the genie, if you'll hand me that container I'll be on my way, and if I am lucky I will not have to be granting any more wishes for a few millions of years, because it can get to be a terrible strain, this taking orders like a waiter from all these newcomers upon the Earth.

And Dave handed him his extended-circle of a container that wouldn't break or bend, and the genie went out the way lightning disappears, leaving a bright stain on Dave's eyes for a few seconds, and far out in the Arabian Gulf Dave saw a splash and figured that the container was seaborne out there somewhere.

Heading, I am driven to suppose—and after a good deal more time, to be sure—for Aladdin.

Now, all this is strange enough, Stan, but it is not the end of the story. The end of the story is a praiseful, even worshipful description of Dave's son, Dave the Leader-and-then-some.

It is a description of a Cro-Magnon man. ■

Happy are those who dream dreams and are ready to pay the price to make them come true.

—Leon Suenens

All our decisions are made in a state of mind that is not going to last.

—Marcel Proust

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THE ALTERNATE VIEW G. Harry Stine

PALIMPSEST

A palimpsest is a document that has been written upon several times, often with remnants of earlier, imperfectly erased writing still visible. It comes from the days when parchment was used and re-used because cheap, mass-produced paper wasn't available. We've apparently made some progress because instead of killing animals to provide our communications media, we cut down trees and probably will soon shift to electronic media where we only modify grains of sand (silicon).

While researching a nonfiction book, I came upon my *Alternate View* column published in the March 1980 issue. With small modifications and very little editing, it's as applicable today as it was then. Therefore, I decided to turn it into a sort of palimpsest of my own:

"With regard to large space projects, there are three things to do: one, get the money; two, get the right people on the job; three, get the wrong people off the job."—Count Guido von Pirquet, ca. 1935.

In the October 1979 issue, Jerry Pournelle rightly asks the legitimate question, "Shall we save the world?"

The answer is, "Yes, of course. Who else will do it?"

But we must do it differently than in the past, especially with regard to space activities.

For more than a quarter of a century, I have heard the strident cry that we must get the politicians to put more money into the space program.

It worked once, but it will not work in the future.

We have come through the Great Aerospace-Political Era. It is finished. Like the Beat The Russians Game, it can no longer be played.

The Great Aerospace-Political Era began on October 1, 1932 when Wernher von Braun went to work for the *Waffenprufamt* of the German Army under Captain Walter R. Dornberger. Von Braun and his colleagues thereafter convinced the German government to provide the funds and facilities for their rocket research. this effort resulted in a ballistic rocket that could take 10 times the payload of the legendary Paris Gun to twice the range with half the dispersion. It is known today as the German V-2

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rocket.

The V-2 was a major advance in rocketry but a lousy weapon. It was rushed into production before all the bugs were out of it. It had continual and significant cost overruns.

But the V-2 would take a payload of 1,000 kilograms to an altitude of more than 200 kilometers if everything worked right, which was seldom. As such, it was touted as the first space ship.

After World War II, von Braun came to the United States, bringing with him a large number of his colleagues from Peenemünde. This was known by the U.S. Army Ordnance Corp as "Operation Paper Clip."

In the ensuing quarter of a century, von Braun proceeded to teach American aerospace managers the most important thing he'd learned: How to get on the government teat and have your hobby paid for by the national treasury.

And, oh, the Americans learned very well! That is certainly one thing you can say about Americans: They may not always be first. But, by God, when they get their arses in gear, they do it bigger, better, faster, and more expensively than anyone in the world! Why, even the British bought most of their modern jet fighter planes from the United States even though the British *loaned* the Americans a Whittle jet engine to play with at first. And until Ariane came along, the Germans bought their rockets from the United States to launch their scientific satellites.

N.B.: I am not saying that what von Braun and his American aerospace acolytes did was wrong, incorrect, unethical, immoral, or improper. It worked at the time. That is what was important.

But it doesn't work any more.

I was there in the main control room and studios of CBS in New York City with Walter and Wally and Arthur during Apollo 11. I was their science consultant. I saw the beginning of the end of the Great Aerospace-Political Era. People such as Dr. W. Walter Menninger, Kurt Vonnegut, Jr., Gloria Steinem, Ira Magaziner, and Dr. Ralph Abernathy began to ask embarrassing questions such as, "All this is very well, but who is making a buck out of this other than a bunch of people who have been doing it as a hobby all their professional lives? Where does the Man-In-The-Street come in? How do *we* make a buck out of it? As entertainment, once you've seen one Moon landing, you've seen them all!" Minutes after Armstrong set foot on the Moon, a man at the Soul Festival of the Harlem Cultural Festival said, "You know, like never mind the Moon, let's get some cash in Harlem!" A lot of people saw their tax money being spent on somebody's pet project and they wanted it spent on *their* pet project instead.

I think von Braun sensed this and also sensed that he had won the Moon but couldn't win any further battles. I knew and respected von Braun, and I watched him slowly come apart in the years following Apollo 11. It was tragic.

But the Great Aerospace-Political Machine ground onward and upward, culminating in the purely political

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Apollo-Soyuz mission in 1975.

But it had peaked in 1965.

Think not? Go back and look at the NASA budgets from 1958 to the present. Accounting for inflation, where was the peak?

The Great Aerospace-Political Machine did not get the message when the Boeing SST was canceled.

The Great Aerospace-Political Machine did not get the message when three of the Apollo lunar landings were canceled.

And the Great Aerospace-Political Machine still hasn't gotten the message today. [Author's note: Remember, this was written in 1979. It is still true today.]

The message is simple: "Get StarTrak (the space-going Amtrak) off our tax-paying backs, get it into the hands of private industry, and make it pay a return on investment to us."

"But nobody is going to take the risk and put up the capital," comes the cry from the aerospace types.

Nonsense! You in aerospace have got to learn *how* to sell space to American investors. Look at Boeing. Sure, they dumped a cool $16 million of their own money into the Model 707, and they knew how to sell it to the USAF as the Model 717 tanker. Then they had to go out and learn how to sell it to the domestic and international airlines, the outfits who had to make a buck with that airplane. Boeing learned its lessons real well. It's hard to beat Boeing in the airliner marketplace today.

In the opening of the American West, the government did not build the roads. And they sent troops only when citizens raised hell in Washington. The canal system of the early 1800s, the transcontinental railroad, and the early reclamation projects of the west were *not*—repeat, *not*—built by government. They were built by private enterprise, operating with guaranteed loans, government grants, and other government incentives. It has been only since the 1930s that the government has been involved in such projects as Grand Coulee, TVA, and the space program.

But space transportation is claimed to be far too expensive and far too risky. It is claimed that it involves the highest technology, which is expensive.

High technology is not expensive. However, crude and primitive technologies are until they become refined. Saying that high tech is expensive is admitting that you still don't know how to make it work economically. That means it's primitive.

Earth-to-orbit technology has been with us since mid-century. Other nations, including Iraq and India, have achieved orbital capability with their indigenous launch vehicles.

It is quite feasible today, with a modest financial investment, to build and operate a manned orbital spaceship.

I have personally been down a similar road myself in a different manner. In 1957, young people all over America were killing themselves trying to make their own rockets to emulate their heroes at Cape Canaveral. Thanks to a shoe store owner in Norfolk, Nebraska, named Orville H. Carlisle, I stumbled upon the answer: a

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model rocket made with model airplane technology using a factory-loaded solid propellant rocket motor made with pyrotechnic technology. It was a pure and simple private enterprise operation. I was told by the professionals at the American Rocket Society and with many of the aerospace industries that it was totally impossible to put rockets safely into the hands of young people. It would be too expensive, too dangerous, and illegal to boot. Well, today there have been more than 500 million model rockets flown in America without a serious injury, the model rocket industry grosses more than $35 million annually, and I became the chairman of the national committee that writes the model laws for fireworks and model rockets. So don't hand *me* that aerospace propaganda about space transportation being too expensive, too risky, and too dangerous. It doesn't have to be if we follow von Pirquet's admonition.

Yes, we science fiction authors, readers, buffs, and fellow travelers of the conquest of space *must* stick together and save the world by moving the human race into space.

But we can no longer expect to succeed in doing it by writing members of Congress, writing the White House, supplicating NASA, and trying to get the space budget increased.

That game is over and we cannot play it any more!

What we must do now is to convince entrepreneurs that there is a big buck to be made out in space, that the costs are not outrageous, and that there is a way to get out from under EPA, OSHA, FTC, and the rest of the Washington Alphabet Soup Bureaucracy.

I totally agree with Jerry Pournelle: We must save the world.

But we must save it differently than we have tried to do it in the past.

Getting to the Moon and keeping Skylab manned for months were only the first steps. Time for Lewis and Clark to step aside. Time for D.D. Harriman to take over.

If we are going to save the world, as we must, then we must also stop playing the old game and become involved in the new fracas: getting government *out* of space and getting private enterprise *into* space.

The Old Era in space is dead! Long live the New Era! Viva la revolution! ■

Henry Clay . . . did say: "I would rather be right than President." It may sound like sour grapes, but I would rather be practically anything than President.

—Will Cuppy

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Illustration by Randy Asplund-Faith

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"Who do you think you are? D. D. Harriman?"

"Nope. Harriman had it easy," I said. "More like P. T. Barnum!"

That verbal melee took place in a hotel hallway at Norwescon 17, just after the debut presentation of The *Artemis* Project.[1] D. D. Harriman, the title character in Robert A. Heinlein's classic science fiction story "The Man Who Sold the Moon," used overt salesmanship to talk a reluctant board of directors into financing the first flight to the Moon. In the story, Harriman had his share of challenges, but the obstacles Heinlein imagined are a mere shadow of those confronting private space ventures in the late twentieth century. But there is a way. We can get to the Moon the way P. T. Barnum would do it—with *The Greatest Show on Earth.* Or Elsewhere.

For twenty-five years we've tried to find a way to get back to the Moon. Hundreds of studies have developed elaborate plans for lunar bases and transportation systems. Space activists are working to strike down laws that stand in the way. Hopeful enthusiasts have examined the economics and come up with schemes for exploiting lunar resources to make a lunar base pay for itself in the long run. But all those plans have been blocked by the same harsh reality—there's no way to get started. The size of the initial investment needed for a lunar base coupled with the time investors have to wait to see a profit defies all attempts to develop a serious business plan.

Any successful space venture must overcome three major obstacles: technical, political, and financial. We jumped the technical hurdle long ago. With *Apollo,* the U. S. taxpayers bought the tools to prove it could be done, with the Shuttle they proved reusable spacecraft would work, and today the space station program is putting the finishing touches on the systems people need to live in a space environment. Thousands of space enthusiasts are working on the political hurdles, finding laws that inhibit private enterprise from going into space and working to change them. Politicians are driven by public opinion, and if enough people become interested in having private enterprise get into manned space flight, efforts to change the laws will succeed.

But the financial problem has remained unsolved until now.

Recent history abounds with proposals for development of extraterrestrial resources, each promising fantastic profit in the long run. When we started the first local chapter of the L5 Society in Seattle back in 1976, I took the show on the road in 100 public lectures during the next two years. The story then was solar power satellites, huge orbiting space colonies to build and maintain them, and a lunar mining facility to provide the raw materials. The books appeared to

[1]Don't confuse the *Artemis* Project with NASA's Common Lunar Lander study. After the *Artemis* Project got its name, we discovered a group at the Johnson Space Center was using the name "Artemis" for a vehicle designed to land a small (less than 200 kg) robotic payload on the lunar surface. NASA dropped funding for the Common Lunar Lander in 1993.

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balance at around $30 billion, and after that the profit would come rolling in; but there was a fatal flaw. Half a human lifetime lay between the initial investment and the break-even point. Private enterprise is just not set up to wait that long to realize a profit on an unknown venture. For a while we thought perhaps life insurance companies would go for it, but their long-term investments are locked up in safe, reliable securities rather than wildcatting adventures in space.

Even a government used to spending billions of dollars the way most of us buy soda pop, was unable to cope with the duration of the project. "Not one penny for this nutty fantasy!" declared Senator William Proxmire. It soon became clear that balancing the books some time in the far-distant future was not going to work. A whole new approach was needed, and none was forthcoming. Its members discouraged, the L5 Society degenerated from a project-oriented movement to a political lobbying organization with no specific goals.

The governments of all the world's leading industrial nations have managed to bankrupt themselves. There's no point looking to them for leadership in space; they can't afford it. It would seem that, despite the long-range promise of developing the Moon, it's impossible to take that critical step.

The world has changed since "The Man Who Sold the Moon" was published. With the *Apollo* program, we solved the technical problems and proved it can be done, but because of *Apollo* our only model for space flight is the incredibly high costs of government-sponsored manned space programs. A host of laws and treaties stand in our way, each seemingly designed to keep private enterprise out of the space business, and the government regulations to be dealt with make a stack higher than a Saturn V rocket.

Fortunately, today's world also provides us with the means to solve those problems—the economic and political power of the entertainment industry. We can develop the political clout necessary to change most of those laws and pay for the initial development of a lunar base with its entertainment value.

Very few *Analog* readers need to be lectured on the promise of extraterrestrial resources and the strategic importance of the Moon in developing them. To the average citizen, though, everything we have done in space, from the meticulous glory of the *Apollo* program to the wondrous images Voyager sent back from the gas giants, is little more than just another form of entertainment. It's Monday night football, Friday night happy hour, and every night's evening news and sitcoms. That is precisely why the *Artemis* Project will work.

The Artemis Project

The project began as a mental exercise. Over lunch and happy hours, we kept asking ourselves the same questions. Why don't they go back to the Moon? Why is manned space

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flight so expensive? Why don't they cut out the bureaucracy and get the costs down to a reasonable level? Why don't they develop space by exploiting the resources available from the Moon? Why don't they...?

The answer to these questions always came back to the same thing: money. So we started digging into the money question, approaching the problem from both reducing the cost and where the revenues might come from. In less than a week, it started to come together.

"Enough with asking 'Why don't they?' " I said. "Why don't *we?*"

That question defied an answer. So we did.

Thus, in 1993, the *Artemis Project* was born. Our analysis showed that a privately financed commercial venture could establish a permanent, manned lunar base and at least begin to exploit the resources of the Moon for future development of space travel. To make it work, we would have to minimize government involvement; it would be a 100% commercial venture, which means it would have to be privately financed. And it had to show a profit from the first flight to the Moon.

We talked with the experts in manned space flight, interviewed managers whose experience dates back to the *Mercury* and *Gemini* programs, and dug into the potential income from such a venture. The deeper we dug, the better things looked. Eventually we decided to continue on with the project until we discovered a fatal flaw in the plan. We did that public presentation at Norwescon as a trial balloon and received an overwhelmingly positive response. People experienced in investing in space ventures, albeit mundane ventures by comparison to a private Moon base, found out about the project and expressed their interest. In early 1994, when we still had not found a fatal flaw, we set up the Lunar Resources Company to bind the activity together. In the summer of 1994, when this article was written, we were working on turning the company into a public corporation, still looking for a reason to stop, still looking for that elusive fatal flaw.

We found it is easy to become distracted with the big picture and wind up spending all our time day-dreaming about what people will do with oxygen, aluminum, helium-3, and whatever else we might dig out of the Moon. To keep ourselves focused, we established four major goals for the project: (1) To establish a permanent manned base on the Moon. (2) To exploit lunar resources for profit. (3) To demonstrate that manned space flight is within the reach of private enterprise. (4) To bootstrap private industry into manned space flight. To focus the activity even further, we decided to concentrate on the first *Artemis* flight, which places a habitat on the Moon for permanent occupation.

Early in the project, we decided to go back to the tradition of using names from ancient mythology for manned space flight programs. *Mercury, Gemini,* and *Apollo* carried human beings to the Moon in less than ten years, but manned space programs lost sight of their exploratory

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nature and fell into lethargic bureaucracy when they adopted more pedestrian names like Skylab, the Space Shuttle, and the Space Station. We settled on the goddess Artemis as our namesake.

Artemis is the twin sister of Apollo in Greek mythology. She is the Moon, and Apollo is the Sun. Artemis is also the goddess of the hunt, a constant reminder that our project is a voyage of exploration, a venture which will live off the land in its travels and return products of great value to our home on Earth.

Reference Mission

To conduct a serious feasibility study, we needed a reference mission. It didn't have to be elegant; it just had to work. That would give us enough to determine the mission costs and identify the obstacles. As long as financial, political, and legal obstacles can be overcome with the resources available to us, we haven't found the fatal flaw we're looking for. We plan to continue refining the reference mission and the business plan that goes with it until we find that flaw. Each step expands the resources available so we can get closer to establishing a lunar base. If we haven't found the flaw by the time we're on the Moon, then we did it!

The reference mission is being used in the current feasibility study to determine costs, revenues, and technical and political issues. Right now we are looking at only the first flight. Like nearly every other study of lunar bases, the overall mission profile shown in figure 1 is similar to a typical *Apollo* lunar flight. This mission profile gave us the timeline and rocket burns listed in figure 2. This is a reference mission timeline, used for costing and feasibility studies only. In fact, the Moon is in the wrong place for the dates shown in July 2002, but the timeline is quite sufficient for the current study.

The trajectory and landing site are based on the *Apollo 16* flight profile. *Apollo 16* landed near Descartes Crater in April 1972. Unlike the *Apollo* flights, the reference mission profile assumes we loiter in Earth orbit for two days to stack and check out the vehicle at the start of the flight.

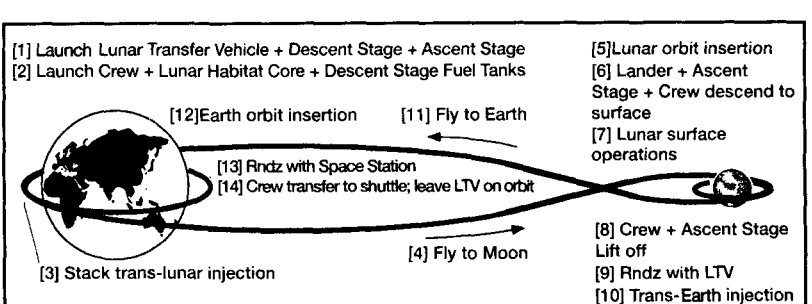
[1] Launch Lunar Transfer Vehicle + Descent Stage + Ascent Stage
[2] Launch Crew + Lunar Habitat Core + Descent Stage Fuel Tanks
[12]Earth orbit insertion
[11] Fly to Earth
[5]Lunar orbit insertion
[6] Lander + Ascent Stage + Crew descend to surface
[7] Lunar surface operations
[13] Rndz with Space Station
[14] Crew transfer to shuttle; leave LTV on orbit
[8] Crew + Ascent Stage Lift off
[9] Rndz with LTV
[10] Trans-Earth injection
[4] Fly to Moon
[3] Stack trans-lunar injection

Figure 1: Overall Mission Profile is Similar to Apollo.

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The first step is getting to low Earth orbit. We turned to existing launchers for our reference mission. As shown in figure 3, two Space Shuttle launches will be used to get the *Artemis* hardware into low Earth orbit, where the Moon vehicle will be assembled. Our crew goes up with the hardware on the second flight.

If the International Space Station is available and the launcher can deliver our spacecraft to it, we plan to use the space station as a staging base. If not, we will launch the first element on one flight and then rendezvous with it on the next flight. In that case our crew will use the Shuttle as a staging base for assembling the *Artemis* spacecraft.

The Space Shuttle was selected as the launcher for the reference mission because, although it is the most expensive launcher in the world today, it is also the most capable man-

Timeline for the First Flight

Event	*Date & Time (Day: Hour: Min: Sec)*	*Delta T Sec*	*Vel fps*	*ΔV fps*	*Applied to . . .*
Launch	4:08:00:00				
LEO Insertion	4:08:11:57	717	25,604		Stack
Translunar Injection	6:08:11:57	172,800	25,631	27	Stack
TLI Burn Termination	6:08:17:32	335	35,649	10,018	Stack
LUNO Insertion	8:22:03:20	222,348	2,807		Stack
Descent Orbit Init	9:12:14:12	51,052	5,486		
DOI burn termination	9:12:14:36	24	5,280	206	Stack
Undock and Sep	10:05:52:13	63,457			
LTV circ. burn Init	10:07:20:27	5,294	5,724		
LTV circ. burn term	10:07:20:32	5	5,344	100	LTV
Descent Ignition	10:08:13:23	3,171	5,571		
High gate	10:08:22:43	560	355		
Low gate	10:08:24:05	82	80		
Verticle descent	10:08:24:45	40	10		
Landing	10:08:25:24	39		6,696	Desc
LTV plane change #1	12:14:07:30	193,326	5,356		
Burn termination	12:14:07:39	9	5,355	159	LTV
	Lunar surface operations				
Ascent Stage liftoff	17:08:25:24	411,465			
Insertion	17:08:32:38	434		6,048	Asc
Rendezvous - TPI	17:09:19:38	2,820		50	Asc
Braking	17:10:00:31	2,453	33		Asc
Docking	17:10:20:15	1,184			
Transearth injection	19:10:20:15	172,800	5,339		
Burn Termination	19:10:22:45	150	8,521	3,212	LTV
LEO RNDZ burn	22:06:19:57	244,632	36,176	10,572	LTV
LEO RNDZ			25,604		

Asc—Ascent Stage LEO—Low Earth Orbit RNDZ—Rendezvous
Desc—Descent Stage LTV—Lunar Transfer Vehicle Stack—LTV+Asc+Desc
DOI—Descent Orbit Initiation LUNO—Lunar Orbit TPI—Terminal Phase Initiation

Figure 2: Reference Mission Timeline

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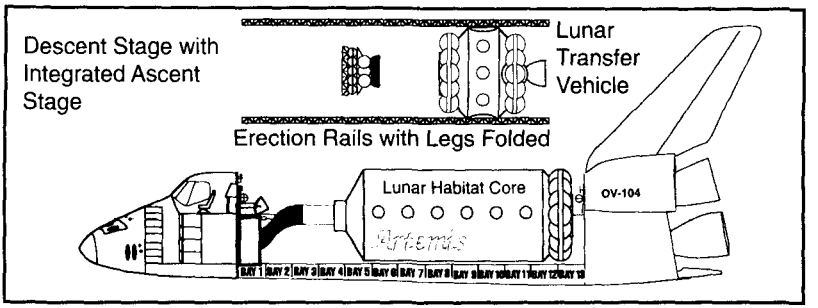

Figure 3: Reference Mission Manifested on Two Shuttle Flights (Top: Hardware carried on first flight. Bottom: Shuttle with second load of hardware and crew.)

rated booster. Current development of new lower-cost launchers in the United States and abroad may change the situation before *Artemis* is ready to launch. Until then the Shuttle is the best vehicle which can satisfy all the *Artemis* mission demands. Also, we are being as conservative as we reasonably can in defining the reference mission. If the costs and revenues balance using the Space Shuttle, then they will look even better with a less expensive launcher.

There are three distinct spacecraft in the reference mission: the lunar transfer vehicle, the lunar base core module with its descent stage, and the ascent stage. Figure 4 shows how these vehicles stack up when we're ready to head for the Moon. The Lunar transfer vehicle is a small space-borne habitat with propulsion systems and support for the crew during flight between Earth and Lunar orbits. The Descent Stage & Lunar Base Core Module consist of a propulsion package attached to the core module's pressurized habitat. The Ascent Stage shown in figure 5 is folded up and hidden by the Descent Stage propulsion systems during the first half of the flight. It is a light weight, open vehicle (often referred to as "a rocket-powered hammock") to return the space-suited crew from the lunar surface to the orbiting lunar transfer vehicle.

These three spacecraft make up the

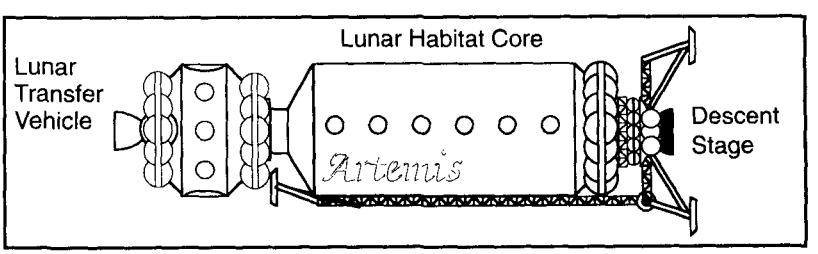

Figure 4: The Stack at Translunar Injection.

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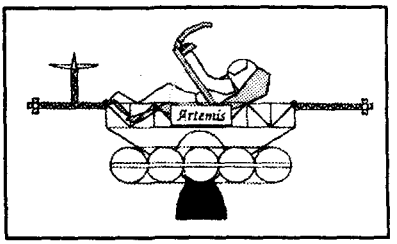

Figure 5: The Ascent Stage.

stack which is flown to the Moon. After the stack is assembled at the space station, the lunar transfer vehicle's rockets are used to fly to lunar orbit.

Upon arrival in lunar orbit, the lunar base core module with its descent rockets separates from the lunar transfer vehicle and lands on the surface of the Moon. While the crew is flying down in the Descent Stage, the Lunar Transfer Vehicle circularizes its orbit around the Moon at an altitude of 60 nautical miles. Advances in automation technology and guidance and control systems since the *Apollo* program will probably allow the Lunar Transfer Vehicle to remain unmanned during the surface operations. We are assuming automated guidance can handle the necessary orbit circularization and plane change without the need for a human on board. If so, we save the additional weight required to support an LTV pilot during the mission.

For controllability, the lunar base core module is oriented vertically until it reaches the lunar surface. On the Moon, the crew levels the lunar base core module as shown in figure 6 and reconfigures the lunar base for permanent operation. After landing vertically, the descent stack drops a foot at the end of a long truss to brace against, and then the core module rotates into position.

During their visit to the Moon, the crew conducts extravehicular activity to assay the site and gather samples of the lunar regolith (Moon dirt). They also set up cameras to get stock footage of the site and their activities, as well as to record their ascent and the arrival of the next flight. (They film activities throughout the flight, both stock footage and scripted scenes for later use in movies and documentaries. Remember, we're in show business here.) When surface activities are complete, the crew boards the ascent stage and makes the two-hour flight to rendezvous with the orbiting Lunar Transfer Vehicle.

The entire ascent is EVA, with the crew depending on their space suits for life support. The flight should pose no greater hazard to the crew than two hours of surface EVA. We expected seasoned astronauts to balk at this bit of derring-do, but so far the response has been overwhelmingly positive. The primary safety issue that has come up is that until the habitat module is rotated out of the way, the crew has no way to get home. We will address that issue when we get to more detailed design stages; this reference mission is sufficient for now to evaluate the feasibility of the project.

After docking the ascent stage to the Lunar Transfer Vehicle, the crew returns to Earth orbit. Unlike *Apollo,* they do not do a direct entry into

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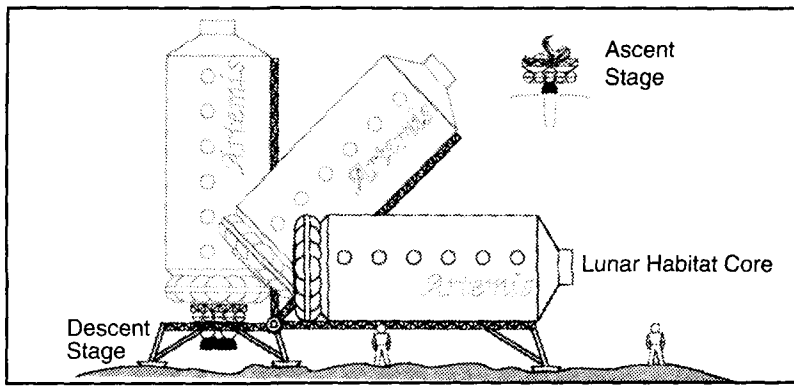

Figure 6: Lunar Habitat Rotates Into Position, Clearing the Ascent Stage.

Earth's atmosphere. Instead, they expend more fuel to brake their trajectory and enter Earth orbit for a rendezvous with the space station.

Carrying fuel for the final braking to Earth orbit reduces the size of the base we can leave on the Moon, but there are several advantages which appear to outweigh that cost. By leaving the transportation system in orbit for use on later flights, we lower the cost of future development. It also cuts the cost of the initial flight by eliminating the need to develop a vehicle which can operate in the atmosphere, and trades the weight of the additional fuel for the weight of the heat shield we would need for atmospheric entry. An alternative to using rockets for braking to Earth orbit would be to use a heat shield as an aerobrake; however, aerobraking technology is still in the early development stages and the expenses of developing it are beyond the anticipated capital resources of the *Artemis* Project.

At the space station, the crew secures the LTV and ascent stage. The LTV may be used at the space station for additional laboratory space between flights, or it may be leased for other operations in Earth orbit. Among the proposals we have received is to fly the LTV on a mission to a Near-Earth Asteroid. With additional fuel tanks plus food and air for the crew, it could perform this mission with little modification. Once the *Artemis* vehicles have been secured, the crew returns to Earth on the next available Shuttle flight.

It is possible (but not necessary) to conduct the entire Moon flight in one Shuttle flight, with the crew flying the same orbiter up and then back down to Earth's surface. This will be an advantage if the space station is not available to support the mission, but the close time constraints eat away at our probability of mission success.

The mission is not over once the crew goes home. To survive the cold,

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two-week-long lunar night, the Moon base will need a lot of insulation. By burying the core module in Moon dirt, we provide the necessary insulation as well as protection from radiation and meteroids. The telerobotic dirt mover (we didn't want to call it an "earth mover") shown in figure 7 is included in the mission plan for this purpose. Since the lunar base can survive several lunar nights using just its heater, this machine does not need to be very large. We can take several months to lay a blanket over the habitat.

Our mission plan was well under way with this little telerobot when another company announced plans to deploy a small robotic rover on the Moon, paying for its cost primarily with its entertainment value. This may provide an opportunity for synergism between the two projects, since a cursory look shows that if we were to add a bit of dirt-moving equipment to their robot, it could do the job. This would add greatly to the entertainment value of the robotic rover and significantly reduce *Artemis* costs at the same time.

The robot may also be able to get camera footage of the *Artemis* stack's initial descent to the lunar surface. If so, it will be first time any vehicle has been recorded landing on the Moon.

Costs

Previous Moon base studies have based their cost models on the performance of government projects and assumed revenues would come only after decades of development. The resulting high capital costs and long term before realizing any profit made it impossible for private enterprise to finance a manned space venture. There is a fundamental flaw to estimating program costs this way; historical cost data based from an exploratory program with an unlimited budget continue to plague space development. *Artemis* attacks the

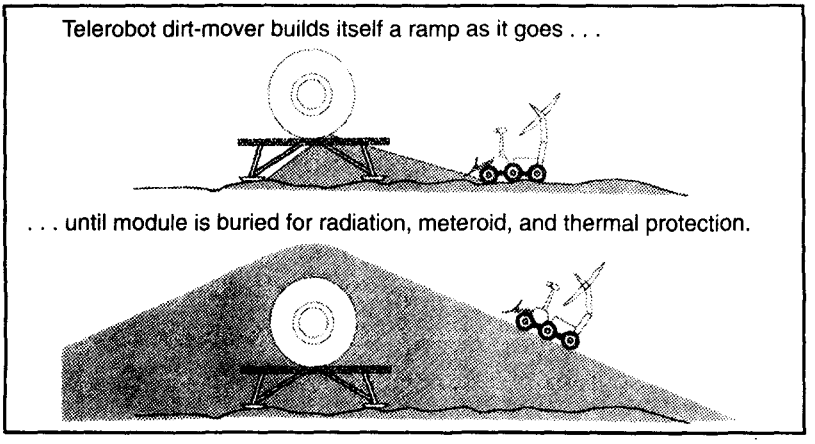
Telerobot dirt-mover builds itself a ramp as it goes . . .
. . . until module is buried for radiation, meteroid, and thermal protection.

Figure 7: Small Telerobot Shields the Lunar Base After the Crew Comes Home.

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money issue at both ends; costs are controlled by being a 100% private enterprise venture, and financing becomes realistic because the project offers an immediate return for the investment.

People who move from private industry to government programs are usually amazed when they first realize how many people it takes to get something done. It can be quite a shock to come from the commercial world, where engineering problems are usually worked out by two or three people in an afternoon, to the world of big government programs where similar problems are debated endlessly in three-day-long working group meetings in rooms filled with as many as 200 people from all over the country. This problem seems to be rooted in the fact that government agencies like NASA are modelled after the folks who hold the purse strings, the U. S. Congress. The Congress is a body of lawyers, not engineers. They were trained to solve problems by holding huge meetings, adopting an adversarial position, and arguing endlessly for their own interests with little regard to logic.

Analysis of government-sponsored space projects[2] shows that no more than 10% of the money, usually even less, is actually spent on developing and operating the spacecraft. The rest goes to the enormous support effort and inefficient organizations necessary to answer the changing whims of the U. S. Congress, support a large institutional bureaucracy with extensive fixed assets all over the world, and to adapt to the government's management-by-meetings philosophy. The government has recently shown that some of these extra costs can be trimmed, but most of the overhead is the inevitable nature of the way governments do business.

Private enterprise does not, and could not, work that way. By organizing as a private company, acquiring resources no sooner than necessary, using the project schedule as a working tool rather than becoming a slave to it, and refusing to allow the project to lose sight of its goals in favor of implementing some politician's social agenda, the costs of any program can be reduced by a factor of ten or more. Additionally, *Artemis* reduces its costs by using technology and resources already developed in previous manned space flight programs.

To develop a detailed cost model for the lunar base, we began by analyzing the work breakdown structure required to accomplish the project. After several discussions with engineers and managers currently working on manned space flight projects we reached agreement on just how much time was needed to do each piece of the job. Then we doubled the man-hours to account for unknowns. A more typical visibility factor—the amount added to account for the surprises lurking in the dark corners of a task—is 15%, but frankly we chickened out. The numbers looked so much lower than our previous expe-

[2]Bennett, Dyson, et al. Analysis based on examination of organizational behavior from 1989 to 1993 in development of space shuttle payloads, space station systems, and management of the U. S. space program. Presented at Norwescon 17, April 1994.

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rience we assumed we must be overlooking something big.

Pennywisdom is another money-waster in government programs. Usually design engineers are hampered by a short supply of the machines and support personnel they need to do their work, so they spend a great deal of their time waiting for the resources they need. We want our people to spend their time in productive work, not in the frustration of waiting to get on a computer while deadlines loom over them. Machines are cheap these days; they should wait for the people, not vice versa. To eliminate this hidden cost, we applied a burdened labor rate half again higher than industry standards for aerospace engineering on government projects. Because of the high visibility factor and burdened labor rate, the costs shown in figure 8 are probably quite conservative.

This level of investment is quite common in the business world. For example, one new deep-water oil rig typically costs about one billion dollars.

* * *

Revenues

Artemis will pay for its initial development by exploiting the entertainment value of the first flights. This is not as unreasonable as it sounds; as I said earlier, to the average citizen manned space flight is little more than a form of entertainment, and the economic power of the entertainment industry is enormously greater than all aerospace endeavors combined. For example, a single major motion picture like *Star Wars* or *Jurassic Park* will gross more than a billion dollars in its first year, with about half the revenue coming from tickets sold at the box office. An often-quoted statistic from the halcyon days of Apollo is that the total money paid for television advertising during coverage of the early manned space flights exceeded the cost of the program, at a time when NASA was spending as high as 4% of total federal outlays. (Today, about one half of one percent of the federal budget goes to NASA's space flight programs.)

First Flight Cost	
Project management	$7.8 million
Spacecraft design	21.8 million
Software development	10.9 million
Operations planning and integration	2.5 million
Integration with launch vehicle	2.1 million
Sales and marketing	20.0 million
Movie Production	120.0 million
Product Manufacturing and licensing	50.0 million
Hardware and Mfg	236.0 million
Launch to low Earth Orbit	800.0 million
Total Cost	**1.27 billion**

Figure 8: Estimated Costs for the First Flight

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This is why the first mission must be manned. The entertainment value of a robotic flight is not sufficient to pay the bills for the lunar base, and that first flight must capitalize on the advance marketing. Imagine a science fiction story in which there were no characters, not even an artificial intelligence; just unthinking hardware. Such a story might be of interest to a few scientists who can wonder at the inner workings of the Universe, but for mass market appeal you have to have people in the picture. Chances are, once they've passed all the other hurdles, candidates for the *Artemis* crew will be selected as much for their stage presence as for anything else.

The estimated revenues from the first flight, listed in figure 9, are based on comparison to similar mass-marketing ventures which tie movies or television shows in with associated products. The *Apollo* program was run with engineering precision, its drama hidden by the need for a government agency to present an unflagging image of confidence to the world. In stark contrast, the *Artemis* Project is designed to be entertaining from the start. With half a dozen science fiction writers already working on the project, we think it is very likely we will attain that goal and still retain the project's major appeal which sets it apart from pure science fiction productions—the *Artemis* Project is *real*. In short, we plan to pay for the initial stages of the project through shameless commercialism.

Again, estimated revenues are somewhat conservative. This is the immediate return; it does not include the profit to be made in the long run by exploiting lunar resources.

Other Space Development and Artemis

While it is possible to develop the *Artemis* space vehicles and conduct the reference mission scenario without it, the International Space Station program adds significantly to our chances of success. There are several reasons for this.

Without a space station, it is extremely unlikely that low-cost, man-

Early Revenues from the First Flight

Movie Ticket Sales	$800 million
Scientific and technical data	200 million
Videotapes, Toys, Games	155 million
Television advertising revenues	66 million
Moon rocks and gemstones	50 million
Educational data	40 million
Books	20 million
Clothing, other notions	10 million
Total revenues	**1.34 billion**

Figure 9: Potential Early Revenues from the First Flight.

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rated launchers will be developed any time in the near future; there is simply no market demand sufficient to warrant the investment. Also, to keep development costs down the *Artemis* Project vehicles and Moon base are based on using designs and technology developed for the International Space Station Program. Elements of the space station's habitats, power, cooling, communications, propulsion, and thermal control systems are all directly applicable to the *Artemis* Project with little or no modification.

Finally, the basic mission scenario calls for using the space station as a staging base for the flight to Moon, and using the station as an orbiting base for the Lunar Transfer Vehicle between flights. We could do the mission during a single Shuttle flight, with the Shuttle loitering in low Earth orbit while *Artemis* flies to the Moon and back; but the time windows are very tight. A space station allows the *Artemis* hardware to be assembled and checked out in low Earth orbit where it can wait for replacement hardware to arrive if need be.

A new way of getting to low Earth orbit could also have a dramatic effect on the bottom line for the *Artemis* Project. The reference mission is based on use of the Space Shuttle for access to low Earth orbit, but many new launchers currently under development promise to dramatically lower launch costs. This in turn increases our chances of success with the project. New launchers could increase the initial profit margin to stunning proportions both by lowering launch costs and increasing the project's entertainment value.

Schedule

The final feature in the *Artemis* Project story is its schedule. We want to get on with development of extraterrestrial resources as quickly as we can, but we are not in a hurry. As a commercial enterprise, the project can wait when necessary for the needed resources to become available; it does not have the threat of being cancelled by an impatient Congress or the embarrassment of headlines proclaiming that the project is late.

The project needed a working schedule to keep things on track. The dates listed in figure 10 assume no major political roadblocks are encountered along the way and the financing becomes available without a snag. A working schedule is a useful tool for managing a project, but we should emphasize that this is a *working* schedule, not an object of worship. Most space flight programs, by arbitrarily adhering to a schedule advertised to the Congress and the public, drive up their costs when one area falls behind while the rest of the team waits for them to catch up. The idle functions of the team usually spend their time institutionalizing procedures and paperwork, establishing new bureaucracies that never go away. A commercial endeavor with all its people working for the same organization can eliminate this schedule-driven cost growth by freely moving resources to where they are needed most and adjusting

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Working Schedule		
Feasibility Study and Exploratory Design		1994-1995
Technical feasibility	spacecraft, operations, long-range mission plans, availability of off-the-shelf designs and key personnel	
Financial feasibility	cost model, revenue model, business plan, availability of capital, cashflow	
Political feasibility	laws, treaties, potential roadblocks, alternatives and work-arounds	
Preliminary Design		1996-1997
Final Design, Development, and Test		1997-2001
First Flight		2002

Figure 10: Working Schedule for the Project

schedule milestones to synch up with the realities of the program.

Digging Deeper

Right now the project is in the viewgraph engineering stage. We're conducting the feasibility study, investigating the costs, legal problems, and financial and political challenges in ever-increasing detail. As we look closer, the technical and cost pictures get better, and the political challenges get worse. We have not yet found an insurmountable problem, but we are still looking for that elusive fatal flaw in the plan. If we don't find it in the next few years, look for us on the Moon. And in your local theater.

If you would like to learn more about the *Artemis* Project, send a self-addressed, stamped business-size envelope to The *Artemis* Project, P.O. Box 590213, Houston, Texas 77259-0213. ■

About the Author

After seven years in design of commercial jet aircraft, Gregory Bennett moved to the Johnson Space Center where he has worked in manned space flight engineering for the past fifteen years. He currently works for a NASA contractor in extravehicular activity development on the International Space Station Program. No stranger to space industrialization, Bennett founded the first local chapter of the L5 Society in Seattle in 1976. That same year he founded the Northwest Science Fiction Society. His novelette "Tinker's Spectacles" appeared in the June '93 *Analog*, followed by "Swan Song" in August. His novella "The Last Plague" was our cover feature in the April '94 issue.

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IT'S ANLAB TIME AGAIN—PLEASE VOTE! Your ballot will be automatically entered in our drawing for a free one-year subscription!

In case you missed the ballot in the Mid-December issue, once again we're asking you to help us via The Analytical Laboratory. Not only will your votes provide tangible rewards for your favorite authors and artist, but your feedback will help guide our selections of what to offer you in the future. Your vote is important!

Look over all your copies of *Analog* dated 1994, or refer to the annual Index in this issue. Pick your *three* favorites in each of the following categories: novella or novelette (a single catagory, for AnLab purposes), short story, science fact article, and cover. If you're not sure about a piece's category, you'll find it listed in the Table of Contents for the issue in which it appeared, as well as in the Index. List your choices in order of preference (your favorite in each category is #1) on the ballot below, and mail it in. The ballot is intended to make it easier for you to vote, but if you don't want to cut it out, feel free to copy it.

Please send your votes to:
AnLab, *Analog,* 1540 Broadway, New York, NY 10036.

To be sure your vote counts, please mail it in time to reach us by February 3, 1995.

Thank you very much!

NOVELLAS & NOVELETTES

1. _____
2. _____
3. _____

SHORT STORIES

1. _____
2. _____
3. _____

SCIENCE FACT

1. _____
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COVER

1. _____
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3. _____

Name _____

Address _____

Please, only vote once!

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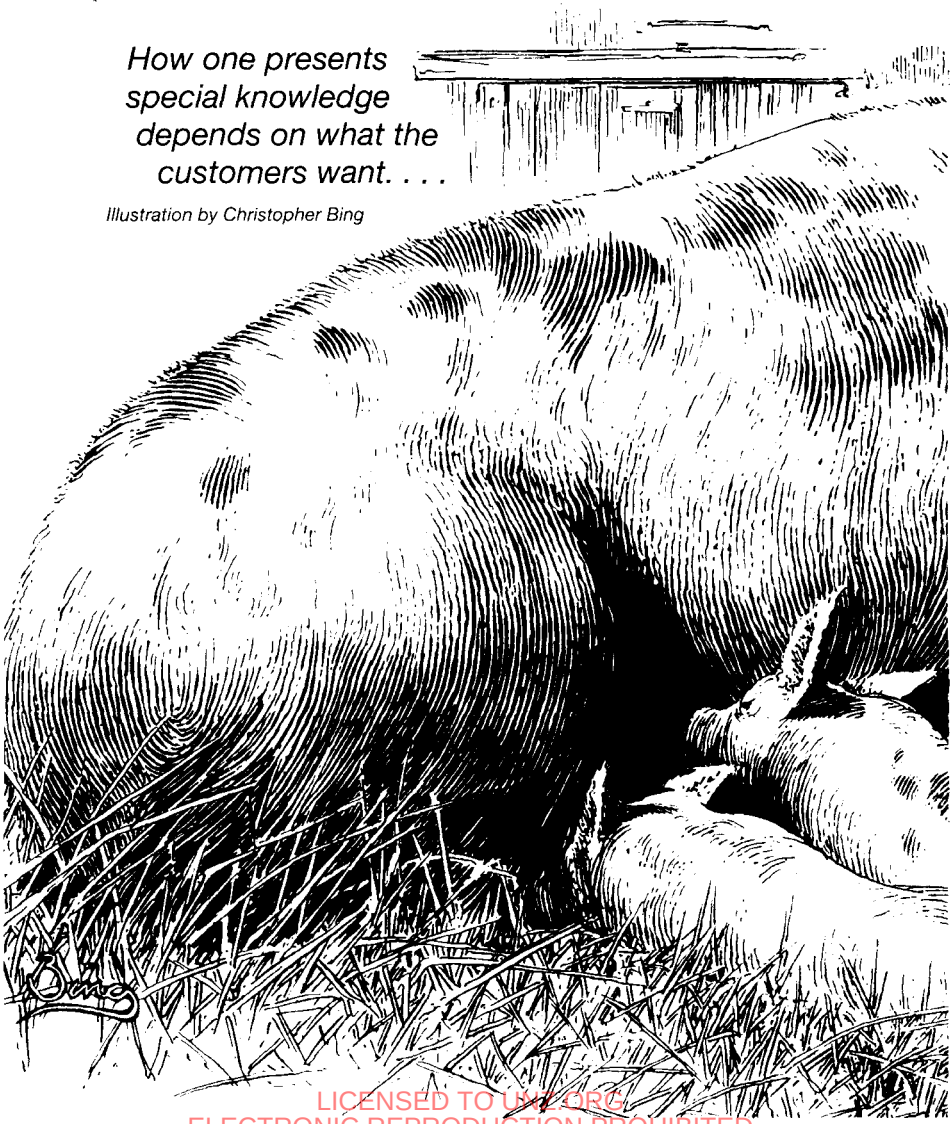
Katherine MacLean

THE KIDNAPPING OF BARONESS 5

How one presents special knowledge depends on what the customers want. . . .

Illustration by Christopher Bing



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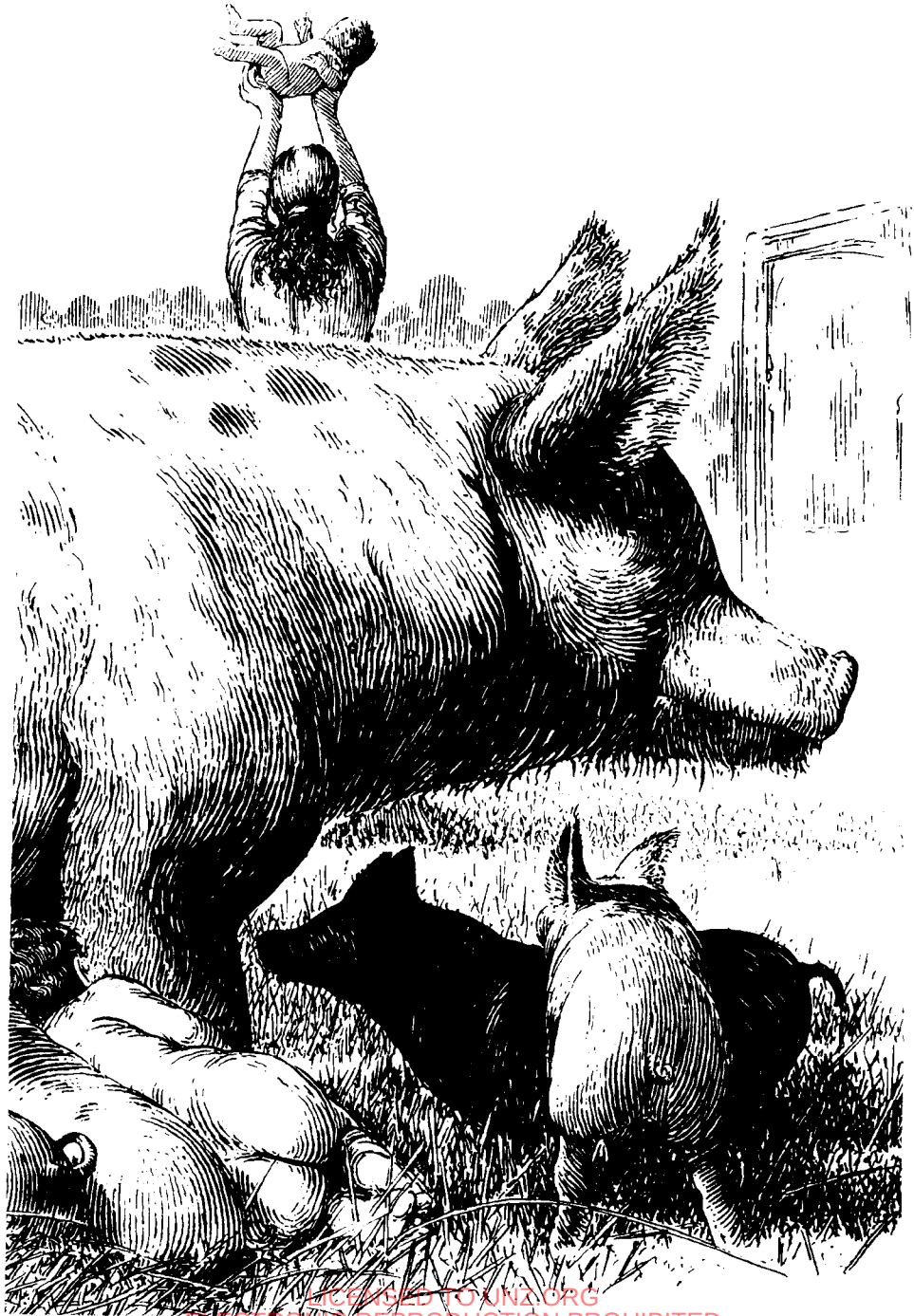

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Her hands were tired from a yesterday of setting broken bones and sewing wounds. Two young sentries had playfully wrestled each other over the edge of a castle parapet, and all their friends and relatives had hovered around while she worked, telling each other frightful predictions of lifelong crippling and assuring her that they had faith in her contracts with friendly spirits and the power of positive healing. They had not remarked that she was using the power of positive bone setting, gluing and sewing.

Occasionally she had remembered to mutter some molecular chemistry to sound mysterious, and once, uncovering some bad damage, she had muttered a genuine prayer directed to luck, fate, the Universal Spirit and the will to live.

Lady Witch let the reins go slack on the neck of her horse and rubbed her wrists. The morning sun seemed too bright. She was feeling a slight headache from the friendly party of celebration that had followed her success. No one feared her in Lord Randolph's area of command. They knew that Lord Randolph and his towns had her affection.

She remembered Lord Randolph's ruddy beaming face, and the pretty children of his wives, and envied them. She let her mind drift to plans to improve their genetic line.

Her horse ambled down the weedy green and brown of Route 111, avoiding holes and wagon ruts.

Her guard of four horse soldiers, three of them teenagers, one of them older, upright and handsome, drifted with her, while they sang an old song and tried to complete a memory of the new words someone had made up last night. Before dawn she had curled on a sofa and slept while the new song words were sung. The wandering choral harmony echoed on the edge of memory with a mood of foggy friendship and romance. Reluctantly she tried to plan a day of hard work in her laboratory and breeding farm, and began to brace herself to be stern and mysterious, to keep her workers terrified of her magic.

Their horses turned onto the familiar stunted sage bushes of the old unused turnpike extension and picked their way along a narrow horse trail beside deep ruts of wagon wheels. Crickets sang and blue jays cawed.

The wind shifted. Their horses snorted and then whinnied with nervous excitement. They had scented something unusual ahead.

Instantly quiet, Lady Witch and her party drew rein and looked along the road. The horse soldiers unslung bows and listened. There was no sound except the singing of birds and crickets and frogs. Cautiously the five moved onward and paused again. Ball-like horse droppings and many hoofprints led from Mountain Road, the route to Lady Witch's land. The new tracks turned east toward the coast and Route 1. Their own horses snuffled and snorted, looking east, and then shifted their interest to nibbling clumps of long grass.

"Last night or early dawn before the ground dried," muttered the oldest soldier. "But they could have left a detachment behind. Stay on guard."

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Lady Witch dismounted and let her horse munch grass while she looked at the tracks. Many small-hoofed horses, presumably carrying riders. Deep tracks indicated heavy wagons pulled laboriously by cattle. The horsemen had ridden in two bunches, before and behind the wagons.

Her escorts stayed on their horses, guarding her, their arrows nocked in their bows, scanning the trees for ambush. Their horses grazed quietly. "Let's hope it is just a traveling show and trade," she said and remounted.

The handsome, older soldier had also been studying the tracks. "If they're not an honest trader circus, they had plenty of time to loot and swing over to Route 1 to get away south. I count about twenty ponies, two old plough horses, and three oxen."

"I count three burros," said a mercenary from the inland plains. "They could be a small part of a nomad army. Where I used to live, pony and burro tracks like this were from an army. They burned farms sometimes, and sometimes in fall took over an area, killed the men, made the women and children work for them and settled in for the winter."

She imagined possible massacres. The oldest gave a command, and the soldiers galloped away, following the tracks. Lady Witch restrained her horse from following, and watched the horsemen call and point where more hoofprints came up from the old railroad trail and joined the first band. The strangers had been numerous.

Left alone, she felt nervous and watched the forest suspiciously. The older soldier returned, bringing the mercenary recruit who knew of nomads. They briskly traded horses, the officer giving up his own big stallion and trading their saddlebags. "Take the fast lane to Lord Randolph and report this."

In the distance the other two horsemen stopped and waved and pointed north, then turned onto Route 1, following the tracks.

"The strangers went north on Route 1! Report that. Go!"

The young soldier put the stallion into a gallop.

"What weapons do you have, Lady?" The officer beside her was busy settling leather plates of armor around his arms and torso. The inlaid enamel insignia on his armor revealed that he was an officer in charge of recruitment and emergency supplies.

She was glad to have the most experienced one to guard her. Ahead there could be looters lingering in captured farms. She checked her saddlebag. "Only a medical kit, a hollow tool handle with some tools inside, and some magic."

"Is any of your magic good in a fight?"

"I can curse them with infertility, make blinding flashes, and conjure up a smoke demon."

"If they came from so far away they've never heard of you, it won't scare them. Can your demon fight?"

"No. Sorry."

"I respect your magic, Lady. You have great skill in healing. But if they

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have never heard of you and you look threatening, one arrow will do for you and your magic together. You should have carried armor."

"I have enough to carry." She felt a headache from lack of sleep, and her eyes strained, looking for enemy motion among the trees.

He tapped his horse forward into Mountain Road, and they galloped southward over the late summer weeds. Black dirt and old asphalt showed through hoof marks, and the wide wheels of loaded wagons had pressed down the goldenrod and dry grass.

Apprehensively waiting to see the first farm along the way, Lady Witch imagined burnt ruins and corpses. When they rounded the bend she was glad to see the familiar shingled house unburned, and the old neighbor alive forking corn ears in a drying rack. She paused for a deep sigh of relief, then called to him. "We're following tracks. See anything?"

The old man put down his pitchfork, squinting to see them. "Nope. I been up since sunup, me and my nephews. Nobody on the road."

The soldier raised his voice. "Did you hear anything in the night, like a crowd going by, or wagons?"

The farmer came closer, interested. "Awful loud wind last night. Gusty. Roaring in the pines. If there had been anything, no way I could have heard it."

"Are you missing anything?"

"Only missing my dog. Off hunting rabbits maybe."

"Or killed to keep him from barking," muttered the soldier.

They galloped away, and Lady Witch looked back and saw the farmer standing in the middle of the road, reading the clear story of hoofprints and wagon ruts. His stance showed worry. No old man and wife and two half-grown nephews could have withstood that pack if they had turned aside to loot.

Lady Witch tapped her heels into the sides of her horse, keeping him at a gallop. The cool fall wind went by her face as comfortably as if nothing could be wrong. The next farm looked untouched, and the metal-repairs man was out in his shed by the side of the road, two ends of a broken axle glowing in the forge. He waved and called, "See the tracks?"

"Saw them," shouted the soldier, not slowing, and Lady Witch looked ahead and shook the reins back to a gallop.

"Who are they?" the handyman shouted after them, but she did not answer. A witch woman should have predicted trouble coming and warned everybody. Best to avoid the question.

The wind was in her face, but there was no smell of burned houses.

She stopped at the entrance to the holdings given her by Lord Randolph, and saw that the wagon tracks and hoofprints had entered and left again.

The gate was unlocked and open. It showed none of the damage that would have been done to it if it had been forced open. Reading the tracks with increasing pessimism, she walked the horse up the steep road. The wagon tracks dented more heavily on the way down. Loaded with

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loot? She mentioned it.

"We'll see what they took when we get there," said the officer. His manner was fatherly. Apparently he did not believe the stories that she was very old, over twenty-five. If he was the sort who went in for disbelief, stories of her powers as a witch probably did not impress him. As she came over the hill she saw glimpses of young workers busily neatening up the yard and repairing fences. Up the hill among the trees a boy tending white goats saw her and waved, but the house workers kept their heads down and kept on working as she and the soldier approached. "Everything is too neat," she muttered. "They must have done something wrong."

No one came from her house and laboratory to greet her. They dismounted and Lady Witch led the way into her house. She saw the cook ducking back into the kitchen leaving two plates set on the table near a covered stewpot. Why were they all afraid to face her?

"Come here!" yelled Lady Witch. "Where is everybody? Is anyone dead?"

A small boy escaped from reaching hands in the kitchen and darted to her, shrilling, "Lady Witch! Lady Witch! The demons have taken Lord Randolph and Lord Jeffrey."

"Oh no!" Lord Randolph and Lord Jeffrey were pigs, but of incalculable value, having been made histogenic organ compatible with the human Lords Randolph and Jeffrey of the same name. The two lords of neighboring counties were overly brave, planning to lead in the front of battle in a necessary war and shorten their already short lifespans. They soon might need blood transfusions and replacement parts. For the rescue of all other patients, piglets that were totally compatible to all humans and loaded with human gene improvements had been born few and stunted, and she had just lost the life of the only surviver—sacrificed for the repair of the two reckless sentries.

"Has Baroness 5 given birth? Is she all right?"

"I don't know! They took her too!" the boy shrilled.

"No!" she ran to the back, but the pens were floored with fresh straw and totally empty. She dashed into her laboratory, startling a boy who was feeding the caged rats. He took a look at her face and fled.

Tears were running down her face. She sat and stared ahead.

A hand touched her arm. It was the soldier, regarding her with a light of eagerness and awe. "Did you repair that radio?"

"Somebody found it in an old cellar. The field reversal hadn't burned it out." She rested both elbows and put her face down in her hands. "What are you doing here? Nobody has permission to come in here."

"I came to tell you there was no blood. The pigs were not killed. The ones who cleaned up the pens and yard told me there was no blood. If the nomads loaded them in the wagons alive, they must have wanted to keep them alive. I thought you'd want to know."

Her staff should have told her when

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she arrived, but they had been afraid to face her. She usually used trickery to impress them with the power of her curses, and she had let them see her talking with smoke demons, but it was all just to make sure they followed scientific directions to the dot. She had not meant them to be so cowed and afraid that they could not tell her bad news.

She called them all together. They denied seeing anything. Gently she asked the boy, Billy, "Why didn't anybody see them take the pigs?"

Billy danced with eagerness. "The demons were out in the wind, howling, and everyone was down in the old kitchen, where we had the doors and windows barred and a big fire in the fireplace to keep the demons from coming down the chimney. I heard the demons fighting the pigs. The pigs squealed and fought and crashed against the walls, but Cook would not let me go look. Can I help you go fight demons and put them back into bottles?"

Lady Witch raised her voice and projected it at the half-open door. "Whose turn was it to lock the gates at night and stand sentry? Send for him. The gates were unlocked!"

When the teenager arrived he was sullen. "Yesterday your smoke ghosts got loose. They turned into fog and floated through the woods getting bigger and making faces. Then they started roaring and shaking the trees. We locked ourselves in the house. I didn't know the demons were going to roar and beat on the house all night, and keep us locked in."

"That was just fog and wind," she said impatiently. Then she wondered if she should argue. Her smoke demons were only a heavy smoke that coiled in rounded shapes and webbed to itself and stayed swaying around the bottle until she put out the flame. The likeness to demons relied on the power of imagination. If her staff had seen huge smoke shapes in drifting fog, their awed stories could improve her fame. She resolved to send these people back to Lord Randolph before their imaginations went berserk. Better to accept a new staff offered by Lord Jeffrey.

But it would be better to let them believe in their fog demons—better to not contradict their stories. She apologized, "I'm sorry. All my power was diverted to Lord Randolph's fort. I was using up all my spells to hold death away from the two young idiots who deserved their bad luck. Nothing was left to hold back the demons."

Still crowding at the doors and windows, young men and women nodded vigorously and agreed in deferential tones. "Yes, yes. It's not your fault, Lady. They got out of their bottles and grew very big. They roared and shook trees. We came here and barred the doors. They beat on the walls and shutters all night."

She gestured to the man to continue his excuses for leaving the gates open. He continued with more confidence, "I know about demons; my cousin was an exorcist. She specialized in demons. Your demons broke the door to the animal stables and took back your demon pigs, and left hoofprints. Demons leave hoofprints."

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Again everyone she employed nodded agreement.

Their lack of reasoning infuriated her. Smoke and fog leaving hoofprints? Demons using wagons and leaving wagon tracks? She took a deep breath to yell at them all. The older soldier moved between her and the man.

"Were they the kind of demon whose hoofprints look like goats or like ponies or like horses?" he asked gently.

"Like ponies!" the man replied, but his glance darted around the room from door to window as if seeking escape from sudden doubts.

"Good. They were in league with some passing nomads who put the pigs into a wagon. We can follow that trail. The demons are not likely to be out in sunshine."

"I'm going to help you get Lord Randolph back!" Little Billy danced with eagerness.

Only children volunteered. The older ones held them back and muttered about smoke demons. She could have ordered them to come with her, but if they were unwilling and frightened they would be useless. She ordered three fresh horses. Somehow she must get back the two boars and Baroness 5, before she gave birth. The nomad thieves would be so startled by what would issue forth from the great sow that they could panic and kill all the sow's offspring, and cause the failure of her medicine plus years of delay in her research. In a very few years another generation would age and die and friends whom she had promised to save would be gone.

The handsome older officer of recruitment, the little boy, and Lady Witch followed the track of the nomad band, galloping past farms and long deserted store buildings and empty churches to a crossroads. There was an inn at the crossroads that usually welcomed travelers with the aromas of breakfast or lunch. Now there were no welcoming aromas and all doors were open and silent.

With an arrow nocked and ready, the soldier sidled his horse up against the wall and listened. No sound. Little Billy slid down from his saddle. He ignored their fierce gestures for caution and ran into the inn. "Innkeeper Roger, Innkeeper Roger, Lady Witch is here hunting the nomads." There was no answer to the shrill childish calls going through the rooms of the inn, but there was a thump, whispers, and rustling from the hayloft above the stable and feet on the creaking ladder, and at last the innkeeper and his daughters appeared, brushing hay from their clothes. He was pudgy and beginning to age at about twenty-two. They were twins still growing. They whispered, "Are they gone?"

The soldier was impatient, "We're following their trail. They are long gone."

The older of the two girls said politely, "Your permission, Lady. We must go see what the thieves have taken." The two girls ran to the inn, and let out shrieks of rage. "Pappa! They took all the kegs of wine."

He remained looking up at her, absently combing straw out of his hair with spread fingers. "Can you do any-

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thing for us, Lady?"

"Not until we catch up. How long since they were here?"

The innkeeper looked at the Sun. "More than an hour."

The soldier snorted. "By the time we catch up they will be having a party with your wine."

Lady Witch felt forlornly that she should have warned them all somehow. She offered an excuse. "I was away from home, and when I returned my pigs had been stolen. It will interfere with my magic. I must get them back."

The innkeeper stayed looking at her, still absently combing his hair with his fingers. "I heard the pigs squeal in both wagons, but I did not know they were your magic pigs, Lady. What becomes of the magic if they are eaten? What becomes of the lords whose names they carry?"

"God knows," said Lady Witch. "I must get them back. The Baroness is about to give birth."

"Give birth to what, Milady?"

"Do not meddle in magic," she replied sharply. "I must be with her when she delivers or there will be—ah, something happening." She made a vague gesture indicating nothing in particular and avoided his inquiring gaze. "I am not here to attack the nomads. Lord Randolph is sending soldiers from the fort for that. I need to be by the side of The Baroness when she delivers, to complete the Magic." She made the word sound mysterious and important. But it was important. Was there no one else in the Solar System doing research on prions? Did they all think that the shortening of life on Earth was only a radiation effect from the time the magnetic poles reversed and would wear off? It was not wearing off, and the level of knowledge was dropping as each generation was given too short a time to pass on more than survival skills to the next generation. With five years delay most of her friends could die. She braced herself for danger. "Get me something to wear that looks like one of the nomad women. I must get into their camp."

They brought her a brown dress. She tied it to the saddle. "Let's go! Hurry!"

The soldier had watered the horses and was splashing water over his head and arms. He rose, dripping, and mounted.

The girls came out and passed up water bottles. "We hope you hit them with lightning, Lady Witch."

She could make no promises of what she could do against armed men, so she was silent. The innkeeper apologized, "I would like to go with you to fight but I have to stay and protect my daughters."

Again they galloped down the turnpike extension, enjoying the level footing of weeds over underlying cement that let their horses run smoothly. Later and closer to the ocean they stopped at a looted farm and helped the family pick up the wreckage of their doors while they listened to their description of the nomads who had just left. Their hens and eggs had been taken, the milk cow had been driven away and some of the garden tools and all of their good clothes and best pots had been

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loaded into their own wagon and driven off with their horse.

The soldier helped them rehang the barn door on its hinges and listened to their story of barricading themselves in their house and hearing the thunderous bursting of the front doors. The house had been invaded and plundered but not one of the family had been hurt or killed, which put a better aspect on the looters.

Excitedly discussing it, the farm family collected eggs laid in stray corners and invited Lady Witch and the soldier to sit at their table, and promised a big tomato omelette breakfast with corn pancakes and butter.

Billy was hungry and eager, but Lady Witch wanted to push on and catch up with the looters. The family agreed to shelter the little boy and let their nine-year-old boy volunteer to guide Lady Witch on a shortcut to get ahead of the nomad army, now slowed by the weight of loot.

The boy guided them away from the road, down a muddy bank of high reeds and into a great saltgrass marsh. The horses protested and walked carefully down a slope of yielding roots to where a small rowboat lay anchored on drying sand. The sand was as hard and flat as a road. The boy gestured them to follow and began to run. They trotted, following the track of hard damp sand. The dampness became puddles then a stream. They followed the sand path downhill. Dark banks of wet roots became higher on each side, and the marsh spread out before them to distant shores of trees. Toward the sea the shore road was hidden by trees. Ahead, puddles widened into shallows of salt water, reflecting banks and sky. The horses advanced into the bright blue shallows with careful steps, found the bottom was hard sand and began to trot again. The boy had run ahead and around a curve; the horses rounded the curve, galloping, and passed him, their hoofs splashing.

Water deepened to the horses' knees. The horses stopped, snorting uncertainly, looking out on a widening bay.

Lady Witch and the officer of supplies drew rein and looked around. To their right the lad waved, waist-deep in another stream. They turned to it and the horses trotted uphill again, snorting and splashing in the shallowing water. The banks were walls of roots populated by small scuttling crabs, they made cool shade against the hot sunlight and a wall they could not see over.

The boy climbed a bank and put his head over the edge. They stood up in their stirrups for height and looked over. They were almost at the edge of the marsh. Ahead, stands of thick bushes and high pines cut off the view of the sea. In the silence, a red-winged blackbird sang a high trill, a cow mooed, a calf bawled, a pig grunted. High voices called directions.

The lad signaled caution. They dismounted and led the horses up a damp sand track. The sun shone hotly on their backs and heads, and the wind shifted toward their faces and brought them a slow rumbling of ocean waves and the aromatic smoke

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of pine twig fires starting.

They put their heads together for quiet talk. "They are starting campfires," mumbled the officer. "Dinner next. You had better move fast, Lady."

Startling them, one of their horses whickered interest in the smell of strange horses. There was an answering whinny from the direction of the nomads' encampment. Lady Witch and the soldier gently held the horses' nostrils to silence them. The soldier handed the reins to the boy and murmured, "If they both start talking to the camp horses, we'll be under a pile of nomad soldiers. Take them back home."

The lad began carefully turning the horses, a hand alertly near their nostrils to avoid more sound while Lady Witch unslung her magic kit from the saddle.

She put on the brown clothing while the officer, sweating and pink in his heavy leather armor, went back to the last puddle and knelt and splashed water over his head and down his neck. He was a good-looking man, with reddish hair that curled close to his head when wet.

Sunlight was hot on her double layer of clothes. She walked back to a deep salt puddle, laid down in it and let it soak her back, then rolled over and put her face under. It was cool and clean in her mouth and nose and eyes. She got up with cold wet clothes clinging to her skin and suddenly felt chilly and exhilarated.

With a wild laugh she took the lead, running. The officer ran behind her, looking at her figure in the wet clothing. The sand path rose toward the surface of the marsh, the banks shrinking lower, not enough concealment now. They ran bent over in a hot shallowing ditch, then went up on the side on hands and knees to enter a thicket of bushes. The stems grew too close together and would not let them in. Making cautioning gestures that warned of listening sentries, the soldier pointed to the opening of a rabbit trail, like a low tunnel through the bushes. He slung his bow and sword well back on his shoulders and forced his way into the trail, leaning against the bush stems and bending them, crawling on elbows and knees. She tucked up her long skirt to let her knees work and followed, dragging her magic kit, crawling with forearms and elbows and knees over scratchy twigs and hard roots.

A change of wind brought her the sweet smell of a well-started wood fire. Fear returned. However fast she crawled, it was only crawling, not fast enough! What if Lord Randolph and Lord Jeffrey, the two boars, were being killed and cut into pork roasts? What if the pregnant sow, Baroness 5, gave birth and her offspring terrified the viewers into killing them all?

She ran her head into the soldier's boot. He had stopped. He reached a hand back where she could see it and gestured with one finger. She followed the gesture, turned aside through the thinning bushes and cautiously crawled to a green barrier of goldenrod and weeds. She parted the greenery and looked out at the nomad encampment. Near them oxen munched at the weeds. Under the cool shade of tall trees a natural car-

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pet of orange pine needles extended in a mile of shade camp ground. Covered wagons were already parked, spaced far from each other.

Children were running to bring water and breaking dry pine branches for the campfires, while a few women and many girls, garbed in scanty mixtures of furs and colorful clothes, were unpacking pots, setting up grills for cooking, bracing long poles and building porchlike extensions to the covered wagons.

"Where are the men?" she whispered.

"They expect attack," he whispered back. "Probably back laying ambushes."

She made an effort to see it from the nomad viewpoint. They were used to being followed by enraged property owners who wanted their possessions back, and occasionally they could expect to be attacked by a small army owned by a local military boss, mayor, police chief, Lord Something, Baron Something, King Somebody. There was no local government without a fort and a small army and a military leader with a title. From long experience of being attacked the nomads were ready with ambushes and counterattacks.

The officer whispered. "What's your plan?"

"I'll walk in alone and make sure the Baroness is all right, then tell them to return her and Lord Jeffrey and Lord Randolph. If they give me any trouble I'll curse them with infertility and nightmares."

He shifted uneasily and looked at her. "Not much of a plan. They'll just think you are a spy for Lord Randolph and do whatever they do to spies."

"Can you think of anything better?"

He looked away from her, back to the camp, and spoke reluctantly. "I can't stop you. If you get into trouble, just whistle, and I'll walk in and claim they're all surrounded by a vast army and I've come to negotiate terms of their surrender."

"Not much of a plan."

"No worse than yours," he replied, "Give me a good-bye kiss in case we both get killed."

She was surprised by his effrontery but pleased by his air of tired wisdom. At his age and experience, perhaps twenty-two, suddenly finding his hair greying, he could see death coming and had no fear of death in war. He knew that life was brief and sweet. In the bushes they tried a short kiss, found it comforting, and hugged.

From the camp came a deep elephantlike squeal followed by a peculiar string of grunts. The pregnant sow, Baroness 5, was beginning to give birth. "Uh oh! My patient calls." Lady Witch detached herself and ran toward the grunting. Ahead she saw a brush enclosure being raised higher by children piling branches. Inside it, behind a small watching crowd, she heard a man laughing and a female voice that chanted, "Soo soo sooo." Another squeal abruptly ended in contented grunts.

As Lady Witch forced through a small crowd of women she heard a male scream of frightened profanity and knew what she feared had happened. All her hurrying had not been fast enough. A man rushed by. "Oh

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my god! Sorcery!" People backing away bumped into her and stepped on her feet. She pushed by them, in a panic to protect the sow, and stumbled into the clear center of the crowd. She felt deep relief and gratitude for her good luck. On the ground before her was the huge sow and her first piglet, unharmed.

"Sorcery!" "Unnatural!" The ring of people backing away stared in horror.

"Sorcery" required good staging. If they fear it, add it to your advantage. Lady Witch reached into her kit, held up both hands and rubbed two objects together. One burst into a blue flame and the other into a yellow flame, and the light grew to a great dazzle.

Women ran and children screamed.

She added her howl to their screams. "Acetaldehyde, ketone. Baroness, turn again human and give birth to the blessed princess."

The enclosure suddenly was emptied of people. They watched from beyond the piled bushes. She threw the flares at the entrance to prevent return of the crowd and knelt at the side of the huge pink sow, who was again squealing and grunting and pushing and giving birth, now garishly lit by the blue and yellow magnesium flares she had salvaged from beached powerboats.

The sow's first issue lay waving his small arms, a healthy human baby, his placenta clinging like a red plastic bag around his legs. The placenta was from his own human tissue and had given him the equivalent of a human mother inside the sow. It had sent out hormones to force the sow and her piglets to accept proximity to human tissue.

"It was a baby!" someone was calling to newcomers beyond the thorn fence.

Various voices called, "Witchcraft! Demons! We have been cursed! Tell the sorcerer. A demon baby from a pig!" People were running toward the flares, asking what was happening. Some of their voices were male, deep and dangerous. A few minutes were left before the bright flares died and let the crowd back in the paddock and some man decided that the answer to all oddities was to kill them. She picked up the baby, cut the cord long and stripped off the rest of his placenta like peeling off a pink plastic package. She wiped the baby with the damp cloth of her dress and cleaned its smooth pink skin.

The infant boy took a deep breath and howled for a mother's warmth.

"Soo soo," she soothed and stood up, cradling him. He put his thumb in his mouth and went silent, looking at her with wide watchful eyes. This one carried some very unusual genes and also was a clone cross of the human males Lord Randolph and Lord Jeffrey and, as such, she had hoped he would inherit both kingdoms, but he did not show the right birthmarks to prove he had been fathered by either of them. He could be raised as an orphan, like Billy. He looked intelligent.

The flares fizzled out and the crowd surged in. She was surrounded by nomad children and young women breathing wonder, awe, and fear of

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witchcraft, and in male voices, angry attempts at explanation from those who did not believe in witchcraft and did not believe a pig had given birth to a human child. A drunken man tried to force his way to the front to kill the child and the others held him back. "Kill the demons," repeated one drunken voice, while another male voice soothed drunkenly, "Only a fake. Don't worry. Only a fake."

"Quiet!" Lady Witch raised her voice over the noise. "I must try to turn the Baroness back to a woman while she gives birth. I must save her next child from being a pig forever. Please let me do my work."

The crowd was ready for a show. They quieted and stared at the sow, waiting to see it turn into a human woman. Lady Witch muttered chemical formulas and felt the great belly to see which shape of bulge was nearest. Then she was busy helping push and then pull. Some of the crowd gasped in horror and others cheered as she pulled out another completely human infant. This one was a female, a clone-cross between her own genes and some dry tissue of a very famous scientist.

Some of the audience decided this was intended to be a magic show, and clapped. The cheering and clapping repeated more loudly when she cleaned this new baby and held her up, like a rabbit from a hat. "The Princess!"

While they clapped, the sow grunted and very easily gave forth four small shoats that were natural pigs, and those began to suckle. The babies heard the sucking sounds and began to whimper and grope the air with lips and tiny fists. They were hungry. Lady Witch laid the babies up against two of the many nipples.

There were gasps of protest from the audience and growls and threats from a few men. In their morality, babies should not suckle sows. Distraction was needed. Lady Witch called out. "We need a volunteer to tend to the babies. This sow is Baroness 5, my captive. She was a Lady Baroness whose real name I keep secret. I turned her to a pig when she disobeyed me. I am sorry for it now, and I am sorry I can't change the enchantment. The babies need to be cared for. They need someone to make sure that the sow does not lie on them. Can anyone volunteer to help the babies?"

"Real babies." "A little princess." Whispers spread among the women. They lost their fear and moved toward the babies with smiles, and bent toward them, cooing. There were noises from the back of the crowd and barked demands to clear the way. Two leather-armored men with short swords and leather shields shouldered through the crowd to Lady Witch and grabbed her arms in a hard grip.

"The Sorcerer wants to see you," one barked.

She stiffened up as tall as she could and glared at their hands gripping her arms and switched her glare to their faces.

A woman screamed, "Ricci! Don't get her mad. She'll turn you into a pig!" The crowd agreed and pointed at the evidence, and the soldiers

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stared at a row of four suckling piglets and two suckling human infants, and understood. They let go of her arm and stood back. One said, "Uh . . . your pardon, Lady Sorcerer."

Lady Witch guessed that the other one was dangerous, for he backed away slowly, his sword gripped tightly in a warding position and his eyes as round as marbles.

The sorcerer-healer of these wandering people had made them too fearful of his magic. This nomad might go berserk from fear and attack her. She smiled at him, "I'm called Lady Witch. Please show me the way to your sorcerer."

To seem less threatening she turned her back to his round-eyed glare and smiled at a strong girl who was cooing at the babies. "You have a good heart. I choose you to help the babies while I am away." She saw a plump young woman also leaning over the babies from the other direction. "And you have experience. Help her. Don't let anything harm the babies. I trust you."

The two nomad soldiers had been whispering to each other. The one who had not been afraid raised his voice, "Come with us. The Sorcerer wishes to see you." He pointed.

"And I wish to see him." She avoided seeming to be a prisoner by walking rapidly in the direction he had pointed, letting the soldiers follow. The crowd trailed, chattering excitedly and hoping for new wonders.

As they passed the nearest campfire she smelled sizzling pork chops and saw a large caldron with chunks of meat, carrots, turnips, and potatoes beginning to boil. All her fears returned. "I hope my two enchanted boars are still alive," she said loudly to the two soldiers and the crowd following. "One is called Lord Randolph and the other Lord Jeffrey. They were stolen from me last night when The Baroness was taken."

"Pigs! The boars are men turned to pigs!" There were multiple exclamations of dismay, and some of the men ran, calling warnings at each cook fire against eating pork from any pig stolen the night before.

The two nomad soldiers brought her to a tentlike building covered with leather, fur side in. She pushed through a double flap. It was darker inside except for orange and white parachute silk draped around the dais, making a bright background of color for the sorcerer. He was thin and wrinkled, wearing a vest of furs turned leather side out and gold chains with pendants of symbols. "Is this the witch?" he demanded of the nomad soldiers. "She doesn't look like a witch."

Lady Witch began to strip down to her whites. The soldiers looked at her nervously. "She came into camp somehow and turned two newborn piglets into human babies," said the calmer one. "She said the sow was a human she had turned into a pig. That's witchcraft. She's a sorcerer."

"Everybody saw it," said the other, nodding vigorously and sweating. He watched Lady Witch throw the brown clothes down and stand in the shining white uniform, shaking her long hair loose, and he backed up

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against the door flaps and halfway out. "She's a tech too! Look out for weapons!"

"Stand outside, both of you!" barked the sorcerer. They obeyed eagerly.

Alone, the skinny man looked at her appraisingly. "You are a biotech! I've found one! The locals down the coast talked of Lady Witch living up this way doctoring and not getting old, and I heard lies about enchanted pigs and demons. I didn't believe them."

"Believe them," she said.

He laughed. "I don't believe lies. You're a biotech. Those pigs are laboratory animals. That's why they say you are a good healer. Genetics and tissue culture. That's what I was looking—" He tried to laugh again but choked and coughed pathetically.

She saw a pattern to his motions, the crying and crouching and wincing of a child being hit, crying disguised by habit as coughing, pain felt as illness. The unlucky man was trapped in a childhood trauma of being beaten. She restrained herself from wanting to release him from it.

He straightened up and glared. "How long will it take you to teach me your foolery?"

"I don't teach my secrets!" she snapped. How could one teach biochemistry and genetics in their short lives? If a girl started to bear children at twelve years old she would die of senility at twenty-five with only three children produced and the youngest only eight. A boy occupied himself with helping the aging olders and learning work skills and fighting.

She liked the sorcerer for being clear-headed about what biotechnology had been all about. Many laboratories had been working on life extension. She herself had been in safe work, transplanting helpful thymus tissue and prion resistant genes from carnivores to herself. But many of her friends were researchers who had suspected prion viruses to be the killer, and complained that the prion viruses they studied worked too slowly to affect mice. She felt guilty on behalf of friends and researchers who had committed a possible great error and accident that no one knew about. New faster prion viruses could have been loosed with the magnetic pulse that burned out all safety controls.

The sorcerer should have been a young man. He was probably only twenty-four years old. He snarled, "You had better try to teach me. I'm master here. You will be a prisoner here until you obey me!"

She replied loudly and slowly, with deliberate clarity. "I will be a prisoner here for a very few days until I finish changing all your people into pigs and you have no one left to obey you."

Certain bulges of listening audience leaning against the outside walls of the tent jerked and vanished, and the soft thudding of footsteps ran away.

She jerked a thumb at the tent walls, "They have sense enough to fear magic."

The old man glared at the walls. "It's a bluff. Fools, cowards!"

"Better cowards than pigs," she said loudly toward the remaining

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bulges of listeners leaning on the leather walls. "Now for our deal. You may keep one of the enchanted children. He is a great general reincarnated. But you must return the Baroness and the two boars and all the horses and the cow and the wagons and carts and tableware and casks of wine your people stole last night and this morning."

He rose and stamped around in a circle, trying to straighten his bent legs. "What do I want with babies who are really pigs or pigs who are really lords?" he snapped, wincing and creaking, "If you are really a biotech, I want the secret of eternal life!"

She sneered at him. "Eternal life? Even if I don't turn you into a pig, you are not likely to live more than another day. The forces of Lord Randolph and Lord Jeffrey already surround all exits from your camp. Only I can persuade them to let your people live."

A breathing presence at the door that she had thought was one of the nomad soldiers turned out to be a large bellowing man hung with swords and shiny armor too small for him. He was bellowing at the sorcerer. "What's this mess you have gotten us into? You senile fool! You led us here with your fortune-telling! You said it would be safe to conquer and settle! No resistance, you said!"

"General," quavered the skinny old man. "There are no armies. Lord Jeffrey and Lord Randolph are only some pigs looted from this madwoman and added to our herd. They can't surround anything."

"Pigs?" the general bellowed. "Our scouts say Lord Randolph and Lord Jeffrey are generals of forts north and west of here and have horse armies larger than ours. And I think we have camped on a dead-end point of land. You led us into a trap."

She spoke soothingly, "There is no danger if you do not shoot first. Just give me an honorable escort without weapons to cart my pigs and drive the other animals back to the farms they were taken from, and I will tell the two lords not to war on you." She hesitated, fear again cramping her heart. "My two boars were taken last night. They are called Lord Randolph and Lord Jeffrey and are very important to the lords of the forts. They must be treated with respect and spoken to politely."

The nomad general turned pale and thoughtful and wiped traces of grease and gravy from his mustache and mouth. "I do not ask the name of every pork rack I eat," he growled uneasily. He put his head out of the tent and bellowed an inquiry and found out that the two boars were still alive.

Happy, she thought of adding to her success by rescuing the farm family's stolen chickens, but the odor of barbecued chicken was already strong in the air of the camp. It was not worthwhile to ask.

A lookout arrived, galloping, and reported that he had seen at least 150 mounted soldiers approaching from two or three miles back on the road and they would have already arrived at the last crossroads and be blocking the single road out. The camp outside was already changed in sound, the

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sharp commands of soldiers organizing a defense.

The general stepped outside into the shade of the pines "What about the marsh?" he snapped. "Send scouts to find a way out through that marsh."

She whistled and the officer of supplies and recruiting rose from the bushes with his hands up peaceably and his enameled armor shining with his insignia. "You are surrounded," he said. "We will accept terms of surrender. Our policy is to give citizenship to immigrants if they get work on farms and join the army."

The old sorcerer straightened, smiling, then turned and glared at the nomad general like an angry hawk. "What do you mean I led you into a trap? Lady Witch has promised she will protect us. Her promise is good. We can settle here. I prophesied that this would be a safe place and I was right. I've been looking for this place all my life!"

The general nodded and sighed.

With the officer of supplies riding a recaptured horse ahead, Lady Witch triumphantly returned, riding in the first wagon with Baroness 5, leading a herd of recaptured cows, horses, and pigs.

They met the army of Lord Randolph and Lord Jeffrey drawn up in battle formation at the other side of a clearing, just past a long bowshot from the nomad soldiers in the trees.

She was glad to see the round pink face of Lord Randolph, as usual taking unnecessary risks by riding around the front line. Randolph, laughing, shouted that he was being attacked by a herd of cows, his own officer of supplies, and a beautiful witch. The officer of supplies and recruitment shouted back that fear of their great army had forced the nomads to surrender, and he and Lady Witch had given their word that the army would not attack them if the nomads returned the local loot, gave back hostages, and settled peaceably for the winter. He galloped forward and rejoined his troops.

She let him explain and led the parade of recaptured animals and loot onward. Past the horse army she was met by a crowd of eager farm families running forward to welcome back their cattle. Little Billy was with them, joyous and important, boasting that he lived in Lady Witch's house and saw her do magic every day.

He was outshouted by the young nomad herdsmen shrilly claiming that they could have won the war, except for the unfair use of magic. They had surrendered only because a dangerous woman sorcerer had appeared in the middle of their camp and threatened to change them all to pigs, and had changed two newborn piglets into human babies to prove that her pigs had once been Lords.

The farm families did not believe that their Lady Witch could do this, and goggled as two young nomad women in the lead wagon held out the infants they carried, and then held them down to the side of the fat sow, where they nursed side by side with the piglets.

Beside the wagon, Billy asked to drive and she gave him a hand up. She passed him the willow switch, but he

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was worried. "Lady Witch, was my mother a pig?"

She had wanted everyone to believe he was only a normal human orphan, but it was too late for that. After the people had seen the origins of the two new babies in the charge of Lady Witch they would understand the sudden appearance of any unexplained babies.

Billy's brows were down and his mouth unhappy. She understood his fear. She had to give them all a story with strength and interest and glamour.

"No, my little scout, your mother was a lioness, and that is why you are so brave." And that was not completely a fairy tale, for carnivores had genes of resistance to prions. And one set of her experimental genes had been from a lion.

Billy was trying to roar the whole way back to their farm and laboratory. ■

I could not, at any age, be content to take my place in a corner by the fireside and simply look on. Life was meant to be lived. Curiosity must be kept alive.

—Eleanor Roosevelt

We must be as courteous to a man as we are to a picture, which we are willing to give the advantage of a good light.

—Ralph Waldo Emerson

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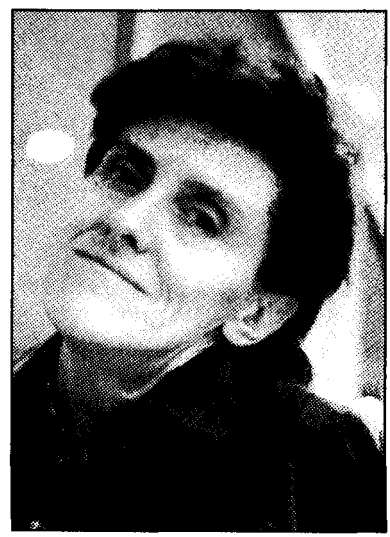
BIOLOG Jay Klein

Katherine MacLean was among the very first of *Analog*'s equal-ability women writers. Several summers back, she was at a Scottish firth doing night-shift repairs on a nuclear submarine in a floating dry-dock, clambering around the missiles, using power tools. The money-maker for her before that was as a portrait sketch artist on the beaches of Mexico. For two years prior to that, she was teaching English at a college in Maine.

During WWII Katherine had a high school summer job in a factory lab helping set up the first large-scale production of penicillin. During college, a second summer job was being a detective. Life seemed so full of possibilities and she had so many bright ideas she wished to explore that like the famous apocryphal horse, she went galloping off in all directions at the same time. Achieving a grant in high school to do a proposed neurological experiment, she decided she didn't really want to spend weekends in a lab. At graduation, she was given a scholarship to study medicine, but passed it on to the runner-up. Instead, her rich grandfather sent her through Barnard for a BA in Economics and an MA in Psychology from Goddard College in Vermont.

Pragmatic as always, she had decided trying to do original scientific research was unrealistic for a woman because no one pays any attention to you for funding until years after you get a Ph.D., and most likely not even then if you are a female. The major influence on her life has been science fiction, with its cornucopia of original ideas. Starting with Burroughs and Wells at six, a year later she discovered SF magazines. Her first SF story appeared in the October, 1949 issue

(Continued on page 245)



Katherine MacLean

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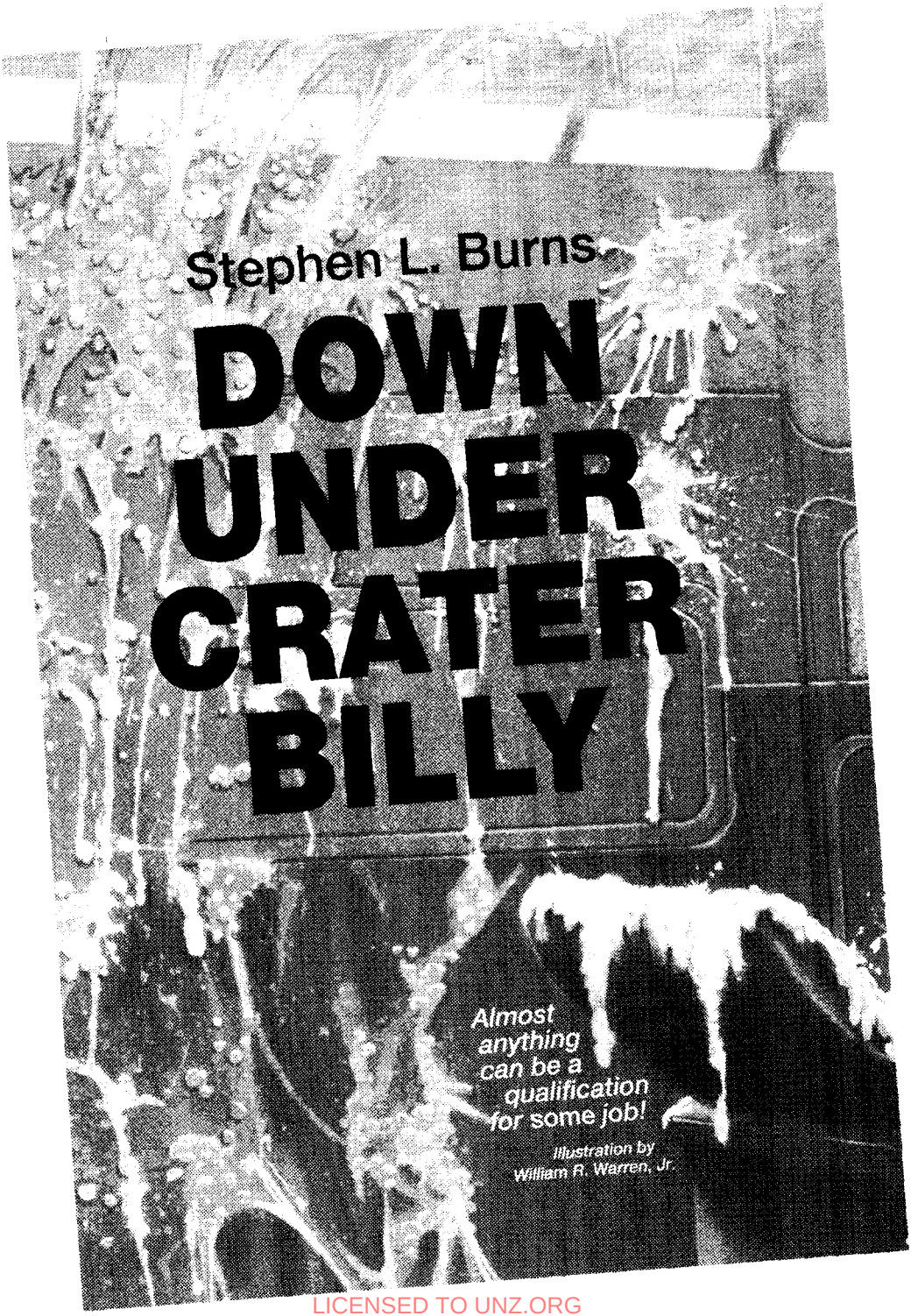
Stephen L. Burns
DOWN UNDER CRATER BILLY
Almost anything can be a qualification for some job!
Illustration by William R. Warren, Jr.

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It began with the office routine of Binkovitch telling me, "C'mon, Dave, this baby's absolutely *foolproof*."

Then the schmuck laughed at this several hundredth-odd iteration of a joke that was stump stupid the first time he told it. As usual, that aggravating, annoying, sludgeforbrains *haw! haw! haw!* made me wish I could reach through the commscreen and whack him one on the top of his pointy head. Preferably with something like a nice big hammer in my hand.

Once again I vowed to actually take one of my unused leaves, venture the hundreds of klicks north to Copernicus Down, visit the UN level, casually drop by UNNTSTOA's section, pop into his office for our first face to face ever, and proceed to beat the living crap out of him. Since I had no plans to ever risk the ride back to Earth and then visit some tropical paradise like Tahiti, that was—and is—my dream vacation.

I took another look at the invoice inset at the bottom of the screen under Binkovitch's ugly ferret face. Half a dozen different new items were listed, but one in particular was giving me the sort of sinking feeling the mammoths must have felt when they visited sunny La Brea.

"Well, at least it was manufactured by Mercedes-Motorola Microwerks," I said, trying to slow my mood's descent into the tarpit. "Their stuff hardly ever goes screwlzy."

"Hardly ever," Binkovitch agreed with an evil grin.

As chief safety officer I had theoretical refusal of any item. But the priority tag the thing carried suggested that trying to navigate the bureaucratic maze it took to do so might be a Voyage of No Return. Aside from that, as CSO it was my job to *have* those bad feelings—and then translate them into safe testing protocols. My recurring ulcer and chronic insomnia were just fringe benefits.

I sighed. "So when's it coming?" I was still clinging hopefully to my one fallback position. Maybe I could stall it in the manufacturer's own testing department for a while longer.

Binkovitch's grin grew even more hatefully gleeful. "Your chief of testing took delivery on it about twenty minutes ago."

There was no way for me to avoid dealing with the damned thing. Not if Gloria already had her hands on it.

If you look over any current map of Luna's Earth-side you'll see several areas marked with holographic red domes, the legend *DANGER! RESTRICTED ZONE! OVERFLIGHT AND/OR LANDING PROHIBITED UNDER ANY CIRCUMSTANCE!*

The reason for the mapmakers getting worked up enough to use exclamation points is fairly obvious with most of them. Only a total moron would try to fly over or land on the Laser Power Columns, Meteor Defense Missile Emplacements, or Mass Catapults and risk being broiled like one of the Colonel's chickens or shot down like a clay pigeon. The human race being what it is, of course a few people do it anyway.

Down in the Midlunar Lowlands at roughly 14°S 50°W is another area

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deemed dangerous enough for this same exclamation-pointed warning.

That's where I live and work, along with around five hundred other lost souls trying to live something like normal lives: loving the ones we love, squabbling with the ones we don't, petting our pets, watching our weight, dreaming of the greener grass on the other side of the fence, and spending the pay we get trying to make existence a little safer for the human race—and for ourselves in the bargain.

We don't have any big lasers, missiles or catapults, and yet thanks to our reputation almost no one ever tries to fly over *us*.

The place is off the regular transport routes, out in the middle of dusty nowhere. It's buried under ten meters of solid rock, and hard to get into or out of as a prison—not that it is one, we're all here more or less voluntarily.

This hazard-marked place is Home Sweet (or at least Semisweet) Home to all of us living here down under Crater Billy.

Once Binkovitch was done getting his jollies for the day at my expense, I left my office and headed off to check out this new threat to our safety and my sanity. Some items we've been given to test bear closer watching than others. I had a feeling that this one would give me eyestrain.

When we were first brought here quite a few people had a hard time adjusting to the ant's life of tunnels and caverns deep underground. Not me. I'm happy as a heavily medicated clam with the warm glow of lightpipes or sunpanels above me, a grass-covered stone floor under my feet, and nice reassuring rock walls all around me. I love the safety of traveling everywhere on foot in the dreamy lunar gravity, secure in the knowledge that there is no motorized transport to possibly break down or go out of control when it passes by, bringing my life to a sudden messy end.

My office is up on one side of Level 2. Testing Operations is down on the other side of Level 4. The most direct route was to cross my level by the Twomain tunnel, then take the ramps down to 4. There are elevators, but few of us ever risk using them.

I hadn't gone more than fifty meters down wide, high-ceilinged Twomain, smiling and nodding at neighbors who were out and about when Sorry, the AI face of Crater Billy's main computer system, spoke up through my wristlet.

"We've got a Code C in the kitchen of the communal dining area, Dove," he said.

"*Dave*," I corrected automatically, watching Lucinda Weems and Arturo Genovese prying Community Room 2F's self-opening doors apart with crowbars as I passed by. We waved at each other.

"Sorry." This was an apology, not an introduction. We were old friends.

"Forget it."

He sighed. "I always seem to."

He did, too. Several times a day. In Jameson Jargon this was an *RITG*, or Recurring Ineradicable Training

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Glitch. For my whole life, starting with my birth certificate, most machines handling my name print or speak it as *Dove Murphy*.

"It's not your fault, old buddy. So what's up?" Code C meant that it posed no danger to life, limb, or Crater Billy's critical systems, and could therefore be considered minor. But as CSO it was my job to know about it. After all, there would be paperwork. There was no actual paper involved, but forms are forever.

"The Kentford 'Kitchen Magician' brand NT-based Commercial Duty Food Transformer being tested in the main kitchen turned flaky again. Would you like the gory details?"

I shrugged. "Why not? I'm already having a rotten morning." In a side tunnel three kids were being stalked by a Sgt. Slaughter action figure gone renegade. They had nets, ropes, and apparently everything in hand. "Don't forget to report, kids!" I called. They gave me the thumbs up.

"Not as rotten as Vangy Spencer, I think," Sorry said. "It appears that her wristlet tumbled the enties' progging. She was talking to her son while setting the transformer to produce a fifteen kilo block of synthetic tofu which she planned to use in one of tonight's entrees."

"I assume that's not what they made." It was hard to imagine it making something worse than tofu, but put Vangy and enties together and anything could happen.

"You got it. The device produced a fifteen kilo block of syncheese instead. One which combined certain identifying aspects of both Swiss and Limburger."

I wrinkled my nose. "Ugh."

"And a fine *ugh* to you too, white man," said Jim Tallfeather, who had just come from that general direction. Then he laughed and clapped me on the shoulder. "Don't go near the kitchen, Dave. It's a feta worse than death." He went on, laughing.

"Thanks, Jim, I needed that," I called after him.

"Jim's report is quite accurate," Sorry continued. "The smell flugged all the air sniffers in the area. Furthermore there was a subsidiary bug in the abnaddled progging. It had to do with the Swiss-like gas bubbling the enties put in the product."

Expect the worst. That's my motto, my job, and my personal view of an essentially hostile universe. Already I could see what was coming next.

"Let me guess," I said as I headed down the ramp to level 3. "Since the stuff was made inside the hermetically sealed transformation chamber, the gas bubbles were at a higher pressure than Billy Ambient."

"An estimated ten times ambient," Sorry agreed. "So when Vangy opened the chamber the gas inside the cheese expanded almost instantaneously, and it—"

"Went up like a bomb." I shook my head in glum amazement. *Exploding cheese.* What a way to make a living. "Since it's a Code C, I take it Vangy wasn't hurt."

"A bit dazed, but essentially unharmed. Jeff and Bob were out in the main dining room having coffee when it happened, so they were onsite in seconds. They handled it."

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"Great. Tell them thanks." Jeff Handel is my Deputy Safety Officer; a bearded, balding guy in his mid-thirties. No ulcer for him, he's so cheerful and easygoing that if I didn't know better I might suspect he didn't take his job seriously. Bob is Dr. Bob Ross MD; a wiry, dark-haired, very gentle guy who happens to be Jeff's spouse and our Chief of Medical Services. Together they could handle just about anything short of the Apocalypse.

"So what's happening now?" I asked.

"Bob and one of his nurses are helping Vangy get uncheesed. Jeff is directing a clean-up crew. He and Gabe Delaney from Testing are starting a report." Sorry paused a moment while the conversations he was having with Jeff and myself converged. "Jeff says to tell you the worst fallout—his word, not mine—is that it may be a few days before the smell completely dissipates."

I shuddered. "Great." My father loved limburger, and tried to get me to like it as well, but achieved the exact bilious opposite. It looked like I was going to be eating in my cubby for a few days, falling back on some of the stuff I had socked away in case of something like this.

"Anything else shaking?" I asked as I got off the ramp on level 4.

"Just the usual Code D's, E's and F's. Want details?"

I shook my head. "No thanks. I'll review them later."

Another twenty meters walk and I'd reached the armored door separating Testing Operations from the rest of the place. As usual, it was propped open with a rock, a sign that read COME ON IN, LIVE DANGEROUSLY! half-covering the one reading DANGER: PROCEED AT YOUR OWN RISK. Gloria, that section's chief, thinks this is funny.

"Consider it done, Dove. Anything else?"

"It's Dave," I said, proceeding on at my own risk.

Here's a little History 101.

First, and as I'm sure you already know, the term *abnotech* was coined by the famous-as-Einstein polymath Dr. Sarah Jameson back in '04, the Newton's Apple leading her to "discover" it's life with her husband Dick.

It's not the prettiest of words, but I guess we're lucky. I mean, she might have decided to call us all *dicks*.

Within two years she'd gone on to devise the Jameson Scale and her Abnotechnia Level Testing series. A lot of people in quite a few different disciplines tried to shoot down the whole concept, but the more data they amassed and the more graphs they made, the more they proved her right. She got her Nobel in Oughtseven, Dick at her side. Her speech was quite moving. His mike refused to work.

The Jameson Scale of abnotechnia runs from 0 to 10. Almost everyone here down under Crater Billy is at least a 7. Most are 8s or 9s. There are a few 10s, though not that many. That's because they're fairly rare, they don't always lead long lives, and the presence of too many 10s in an artificially maintained environment like ours could make keeping it func-

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tioning all but impossible. Not letting any of us anywhere near critical systems down on level 6 helps. Frazzled 1s and 0s working out of a deeply buried bunker six klicks away handle all that, commuting and carrying our supplies through their own tunnel.

Most upper management jobs are filled by 7s like myself, since the problems we cause mostly—a word with one hell of a lot of *give* to it—tend to be simply aggravating.

Being abnotechs means that through no fault of our own, each one of us has an innate negative effect on mechanical, electrical, electronic, cybernetic and nanotic devices, or any combination thereof.

Why we're the way we are is still a mystery. Some think it's our magnetic fields which cause devices to wack out in our presence, but the equipment to measure such things can't be trusted around us. Others think we're probability benders, our very existence somehow throwing tiny monkey wrenches into the fundamental machinery of quantum mechanics. Some vote the Black Aura ticket. Since it doesn't seem to be a curable condition—not even by death; a hearse carrying a dead 7 or over is a lot more likely to break down than normal, the odds increasing with the stiff's rating—the reason doesn't really matter.

Less than .02 percent of the population tests at over 5, and it isn't until you go 6 or above that life in our technological society starts getting noticeably troublesome. Watching people misuse their electronic toys, screw up their cars, and get bitten by folding chairs might make you think our numbers would be higher, but abnotechnia is not stupidity, clumsiness, plain unhandiness, or an inability to read directions. It's something deeper and stranger, buried in our genes or wiring and transmitted on a band nobody's ever been able to pin down.

We may have only become a sociological quantity in '04 but we've always been around. Not long after the wheel was invented one of us got the First Flat. One of us flushed a dead goldfish down the toilet and accidentally sank Atlantis. One of us got the first wrong number, even though there were only three telephones in existence at the time. We've blacked out whole cities by making toast, and crashed whole computer networks by simply pressing ENTER. Devices with multi-million hour MTBF ratings go belly up the instant we buy or try to use them, or they do something their designers never conceived: a car alarm beeper causing every nearby Cash Machine to joyfully spit out hundred dollar bills, or conversely, a simple cash withdrawal setting off every car alarm in a twenty-block radius.

Gloria Lunden was our CTO, or Chief of Testing Operations.

Our jobs were intertwined, and our working relationship somewhat complicated and not always friction free. Two cats with their tails tied together might be an apt metaphor.

New items we were sent were given either Tier 1 or Tier 2 testing. Tier 1 items were first tested by Glo-

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ria and her staff in the Testing Operations labs under (in theory, anyway) strictly controlled conditions. Tier 2 items were sent right out into Crater Billy for general usetesting, her staff monitoring the results in both cases. She decided which tier of testing an item got, following guidelines I set and constantly updated as new disasters made me more paranoid. I checked her testing protocols for safety, and co-processed the reports when an item malfed above the Code F (*Frigging thing doesn't work!*) level. I wasn't her boss, but I did have the authority to make her modify her methodology.

Complicating our working relationship was our even more complicated personal relationship—one which had what I thought of as *on* and *off* modes. When we were *on* we lived with each other and spent most of our free time together. When we were *off* things degenerated into what I think we both imagined married life would be like: lots of fighting and no sex.

I found her in Test Chamber #5, deep in the untidy warren of cubbys and tunnels which made up her realm. Instead of going on in, I just leaned against the door frame and watched her work for a couple of minutes. I was probably smiling. Maybe even drooling.

At this point we'd been in off-mode for a couple of weeks, and I hadn't been down to Testing for a few days. I'd missed her—not that I'd have ever let her know that. It appeared that she'd missed me too.

Gloria and I knew each other far too well. I'd known she'd want to handle this new item personally. She'd known I'd be down to check it out personally. She'd dressed for the occasion. I knew it the moment I looked at her.

First let me correct an oversight. When I write a report there's always a spec-file attached describing the item(s) involved. But this isn't a report and you don't have a file. So:

I'm not not exactly a little guy. I stand 6′3″ and weigh somewhere around 230 pounds Earth-normal. (Here on Luna *things* are measured in metric, but people in feet and pounds. It's illogical, but so what? If you want to get fussy, go convert everything to angstroms.) Although I was big enough to have played football in college I never did; my taste in women and sports—and my mostly nonexistent love-life—had drawn me to Coed Wrestling.

Gloria went to college on a football scholarship and became the foundation of a winning team. She got trophies and set records. The one she's most proud of still stands to this day; it's for the number of ambulance calls caused by a single player.

Gloria is a glorious 6′11½″ tall, and a solid 270 pounds E-n, none of it flab. She's *Woman* written in large sure strokes. The first time I saw her I thought I'd died and gone to heaven.

She's made my life a living hell ever since.

Her two favorite lab assistants were helping her tear the shipping crate holding the item apart. Manny's a 7, a chunky, dark-skinned maniac with a bandito mustache and a mescal-

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drinker's eyes. Anna's an 8, a sallow, ironic blond with *troublemaker* written all over her long thin face.

But it wasn't them I was looking at. I only had eyes for Gloria, and while I knew I was being manipulated I wasn't inclined to complain about it.

Her daunting physique was just barely contained by a pair of faded blue bib overalls worn without benefit of a shirt. The pants had been chopped off high on the thigh to show off a mile of muscular leg, and the bib was straining to contain her considerable bosom in a manner that was nearly button-popping and completely eye-popping. Her broad back was covered only by the biballs' straps, and my eyes were drawn to her smoothly rippling muscles as she pried a plastic slat off the crate with her bare hands.

I wasn't able to remember what had put us in off mode, other than that it had been a fight—probably over work. There was undeniably electricity between us, which meant that there were also occasionally power surges, shocks, arcs, brownouts, blackouts, bad connections and yes, even dead shorts.

I could have just stood there watching her and thinking all sorts of interesting things except for the big box of trouble she was uncrating.

"Morning folks," I said, going on into the chamber.

They all turned my way. Gloria was grinning like a kid unwrapping a giant present on Christmas morning. "Morning yourself, Dave." She cocked her head, putting her hands on her hips and giving me a bit of eyelash batting. "Are you here to see little old me, or to check out our new toy?"

I found my gaze drifting down to where the tender sidecurves of her breasts disappeared behind the faded denim bib. "Can't I do both?" This was phase one, the verbal mating dance.

In the background Anna snickered, then told Manny, "Under a minute and he's toast, man, just like I said." She held out her hand. "You owe me five." They were always betting on our fights and patch ups so I ignored them.

Gloria shook her head, brushing her tawny, tightly braided queue back over her shoulder. "Not at the same time. Not properly."

There was a line you could hang your underwear on. "I see," I said thoughtfully. "Then I suppose it's business before pleasure. When do you get off?"

The smile she gave me could have easily turned my brain into the second pyrotechnic fondue of the day. "Hopefully not long after you get to my place tonight. After dinner around seven?"

I wasn't about to let myself get run down and roped up as easily as that. I had my manly pride to think of, after all.

"Better make it six," I told her. "At my place. I'll fix dinner. We had a Code C in the main kitchen a little while ago. I wouldn't plan on having lunch there either, unless you're fond of Limburger Surprise."

Her brown eyes narrowed. "That Kentford unit malfed?"

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I nodded. "Vangy and her wristlet discombobulated the enties again. Gabe and Jeff are on it. The report should be posted by noon. Nobody was hurt, but it could have turned out a lot worse."

"It made an exploding cheese, Boss," Manny put in, looking up from a pad. He snickered. "The Brie went ba-looey."

"Damn. We keep getting these goofy ISLs, and every time we think we got them plugged Vangy proves us wrong." ISLs are Improbable Signal Leakages. Then she laughed. "So it made an exploding cheese. You've got to admit that's pretty funny, no matter how you slice it."

I scowled at her. When it came to where safety belonged in the overall scheme of things we wouldn't see eye to eye if you glued our faces together. "Maybe you think so. I don't." I pointed at the item they were uncrating. "I sure as hell hope you take *that* damned thing a lot more seriously."

She opened her mouth, probably to say something that would start a fight big enough to short-circuit on mode before it even began, then shook her head and gave me an exasperated grin.

"Don't worry, I intend to." She even sounded like she meant it. Anyone in their right mind would, but this was Gloria. As a tester she *wanted* things to fail, and she found spectacular failures the most interesting.

Still, it was time for me to back off a bit as well. "I sure hope so, Gloria. Do you think it can really be trusted?"

She turned to gaze at it. Anna and Manny had gone back to work uncrating the thing. "The theory is sound. The idea is brilliant, even beautiful. Mercedes-Motorola has already tested the hell out of it, but since it needs and they want Jameson approval, we get a chance to play with it."

I bit back the impulse to say something about "playing" with the thing. Instead I made my position clear right from the start. "I hate the damned thing already."

She faced me again. "I kind of figured you might, Dave. But I think the test setup I have in mind will meet your approval."

"What is it?"

An impish grin and shake of the head. "Now you know what happens if I try to put a setup together with you looking over my shoulder."

"We fight," I admitted.

"The man's a master of understatement," Anna put in over her shoulder. Manny elbowed her in the ribs.

Gloria looped an arm around my waist and gave me a big hug. "Why don't you make yourself scarce for a couple of hours, my love? When you come back we'll have the testing setup in place. Then you can look it over, and if you have the slightest doubts about it we'll work on it until you're satisfied. OK?"

I had to admit that when it came to setting up tests for especially critical items like this her methodology was fairly rigorously worked out. It was her attitude that caused the problems and gave me indigestion more often than not.

"All right," I agreed.

She gave me a kiss for being so co-

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operative, then whispered, "I really do want to keep you satisfied," in my ear.

I knew she was still talking about her methodology, but not one I cared to have Manny and Anna observe.

History 101 continued:

Toward the end of the 20th century product safety testing was becoming an increasingly important concern. It had to be, because if some dolt managed to poke his eye out while trying to clean his contact lenses with his electric toothbrush there was a better than even chance that the courts would award him a settlement large enough to bankrupt the manufacturer.

All right, perhaps I'm being a tad facetious. For every company sued because there wasn't a warning label on the chainsaw instructing the operator to not hold it by the end with the sharp whizzing chain, there was another company selling something that was badly designed, shoddily manufactured, inadequately labeled, and put out there with a criminal indifference to the safety of the consumer.

The thing to remember is that we abnotechs aren't stupid, incompetent or careless—if anything we tend toward the opposite because we learn early on that almost everything in our environment can turn on us. Believe me, being cornered in your crib and reviled by a walking, talking teddy bear run amok can scar you for life. But because of the problems we have with things we often get unfairly lumped in with the blasé, bone-headed and braindead.

Anyway, as more and more companies become concerned with product safety, product testing became an integral part of their operations.

Dr. Jameson was one smart cookie. Not long after she documented the existence of abnotechnia she realized just how useful those of us at the high end of the scale could be in product testing. After all, if there was any way for a device to go wacky or do something that would give the manufacturer's legal department ulcers it was almost certain to happen when an abnotech got their hands on it.

That's how JTL—the Jameson Testing Labs—was born, and a lot of us who tested at 7 or above ended up as safety testers.

I suppose this was a good thing—though nights when I'm lying awake and grinding my teeth I do wonder. Once Jameson Testing was widely accepted, it closed quite a few career tracks to us 7 and overs. No longer were we allowed to hold technology-dependent jobs where our effect on the equipment could spell disaster. That meant we weren't allowed to operate any sort of public transport or work traffic control for such transport, or become power plant personnel, or lay hands on heavy-duty networked computer equipment, or have much of anything to do with manufacturing, or—

Well, you get my drift. We couldn't even holler discrimination because no abnotech with half a brain wanted another abnotech flying the plane they were riding in, or running their life-support equipment during sur-

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gery, or operating the chemical plant upwind of them.

Jameson posited and others proved that the more complex a device became the more likely an abnotech was to have an effect on it. A hand-operated can opener can malf in only so many ways. An electric one can malf in more. Put a high-speed netted computer in the hands of a 10. If it continues to function well enough to cause trouble it can cause *real* trouble, like the Great Minnesota Tax Wipe of '99.

By about 2017 Jameson Testing had become a standard procedure, making JTL into one of the twenty largest businesses on the planet. It was at about that same time the first NT based devices were submitted for testing.

This proved to be a whole other kettle of piranha. Obviously in the hands of an abnotech a poorly designed entie-based anything could easily do something or become something its designers never envisioned even in their worst anchovy pizza nightmares.

JTL knew entietech was the future, and had no immediate plans to be left in the past. The problem was that their Risk Assessors ran their software, and the idea of mixing us and enties had come up with more red flags than an old Commie May Day Parade. If a contracted abnotech's influence turned an entie strain dangerously weird and it got loose, all sorts of catastrophic and highly actionable things might happen.

Jameson herself went to the UN, which was thinking along these same lines itself. That's how UNNTSTOA—the UN Nano Tech Safety Testing Oversight Agency became another bowl of alphabet soup on its table, and how it built and JTL staffed our deeply buried, completely sequestered enclave down under Crater Billy.

Ten years later the worse-case scenarios haven't come true. *Yet.* Nanotech construction takes a certain amount of precision and sophistication to begin with, and knowing what they built was going to be abnotech-tested made manufacturers careful. We've helped them learn a lot about designing fool- and abnotech-proof entie-based devices. But new devices and new generations still have to go through our mill if they want a full safety rating.

Children are Jameson-tested at age two, although 8s and up have been known to proclaim themselves in utero by their effect on fetal monitoring equipment; the sonogram machine suddenly showing "Gilligan's Island" reruns, for instance. Most of us who tested at 7 or above started working as part-time safety testers while children; a young abnotech can generate malfs no adult could ever hope to duplicate. Those of us who've turned pro have spent our entire lives as professional guinea pigs.

As Chief Safety Officer it was my job to worry about this new item we were going to test.

It hadn't even been at Crater Billy for two whole hours and already I was working overtime.

"Well. What do you think?"

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I scowled at Gloria a moment, then went back to glowering at the Mercedes-Motorola MicroWerks Model 1-INT airlock. "I hate it."

"You already said that. Why?"

"*Why?* We're living on the goddammned *Moon,* Gloria! The air outside *ain't!* Lock failure could kill us all." I waved my arm at the thing. "Just look at it! Call me old-fashioned, but I think airlocks should have nice heavy doors that clang when you shut them, and simple, foolproof latches. Not like that, that *thing.*"

The thing in question had been set up by the far wall of the testing chamber. It consisted of a burnished steel frame about two and a half meters tall and one and a half wide, a simple control pad on the right side. There was no sign of nice reassuring steel or even polyplast doors inside that frame. Instead there was this faintly gleaming black surface like a curtain made from some heavy metallic cloth.

I was getting the willies just looking at that black barrier because I knew it wasn't solid like rocks or wood or metal, it was just billions of separate, fallible nanomachines hanging on to each other because they'd been told to, like all the dogs on Earth told to *sit* at once.

I shook my head. "You're not getting me anywhere near that thing when there's vacuum on the other side of it."

She grinned at me. "Too late, Dave. There's a storage chamber on the other side of it that's already been pumped out to surface normal."

I was aghast. "Are you trying to get us all *killed?*"

She looped an arm around my waist, probably to keep me from running away. "I don't want to die. After all, I've got a hot date tonight." A squeeze. "Will you let me give you chapter and verse on the setup before you work yourself into a heart attack?"

"*You're* the one giving me a heart attack." I said accusingly.

She winked. "Maybe later, lover. But trust me, you're perfectly safe right now. Come on and I'll show you."

I let her lead me over to a tabletop display terminal and watched her call up a schematic.

"Here's the chamber we're in now," she said, pointing to a rectangular green box. "It's 10 meters wide, 8 deep and 4 high. That's 320 cubic." Her finger moved to a smaller red box at right angles to it. Red means vacuum. "That's the other chamber. It's 2 wide, 10 deep and 3 high—60 cubic. So even if the lock blew there's still enough air in here for both chambers."

She looked over at me, trying to hide a smug smile. "But I wanted to make our poor mistreated CSO happy, so—"

Her finger pointed out four white circles at the corners of the chamber. "You know what these are."

"Barometric Popper valves. A radical change in pressure will trigger them."

She nodded. "Releasing the pressurized air they're holding back. Enough air to repressurize the room

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to Billy Ambient in ten seconds." She hooked a thumb in one biballs' strap, self-assured verging on cocky. "I'd say that's pretty bulletproof. Wouldn't you?"

"So far," I said, studying the diagram. The chamber she'd vacced was a dead end. It had a gumby mounted in the ceiling to automatically plug any leaks, which were highly unlikely since there were several meters of solid rock surrounding the chamber except on the side facing us.

I had to admit that Gloria's design looked fairly well worked out so far. She's a 7, and her capacity for imagining trouble is almost as finely honed as my own—when she uses it. If there was going to be a weakness in her setup it would be in the safety of the testing staff and subjects. Knowing her cavalier attitude, I planned to go over every detail.

"So what are the test protocols?" I asked, punching in the command to bring up VIEW 2, which was listed on the menu as video from inside the vacced chamber. The schematic vanished.

Manny and Anna had been watching us go over the test plan, remaining uncharacteristically quiet. That ended with Manny going "*Whoo-ha!*" and Anna squealing "Yuk! They left their *socks* on!"

There on the screen before us, instead of a video feed from inside the chamber, were Cindi and Ted Nakamura, indeed wearing socks—only socks—and engaging in some quite spirited early-afternoon sex. Cindi was on top. She seemed to stare up at us from the display, eyes widening and face paling when she saw the red active light on their bedside communit.

"Not *again!*" she wailed. That was my thought exactly. It had only been a month or so before that I'd finally stopped covering all the video pickups if I was doing something I didn't want broadcast publicly.

"What?" Ted moaned thickly, squinting up at his spouse.

"Sorry!" I said, hastily keying in the command to cut the connection. Instead we were rewarded with an extreme closeup of the action. And I mean *extreme.*

"How can I help, Dove?" Sorry chimed in, thinking my apology to the Nakamuras had been a call to him.

"Check out the tattoo," Anna giggled. She and Manny leaned over the terminal for a better look.

Gloria had been trying to keep a straight face, but at this point she lost it, doubling over with laughter.

"Comm-glitch!" I snarled at Sorry. "Fix it!"

Back at the end of the previous century they'd been blithely unable to imagine the sort of potholes, washouts, snarl-ups, side-swipes, sudden detours, strandings, roll-overs, highjackings and head-on collisions possible on the Information Superhighway. If Cindi and Ted were lucky this was only being broadcast Luna-wide.

The table-top display blanked, a final bewildered "*What?*" from Ted, the last we saw or heard of the Nakamuras that afternoon.

"Erroneous feed stopped, Dove," Sorry said. "Anything else?"

"Yes," I snapped. I raised my voice.

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"*Command Mode Invoked.* Authorization *C-S-O 1 D-W-M.* Verify and await instructions."

"Ready." Sorry replied, his voice gone toneless and robotic.

"Terminal privacy override invoked. Extract and report on instructions given this terminal in the last five minutes."

"First command at 1321 hours 42.3 seconds: Display test schematic designated filename—"

"Skip the filenames and times. Next."

"Second command: Display Menu choice 2, video feed from pickup in area designated Test Chamber 5B. Last Command: Cut all inputs and go to standby. Report concluded."

"Command mode *off*." I let my voice soften. "Thank you very much, Sorry. That's all for now."

Gloria had got herself down to where she was only chuckling. I gave her the hairy eyeball. The look on my face made her swallow the rest of her mirth, and she made a face like it had gone down like a bad oyster. Anna and Manny faded back out of blast radius.

Before I could erupt she sighed and held up her hands in surrender. "OK Dave, I get the picture. Never assume *anything* will work properly."

"Not when abnotechs are involved." I glared at the entie airlock as if it was a personal nemesis. "Your setup has been pretty well planned so far, but I'm not going to be satisfied until we have every possible problem covered six ways to Sunday. All right?"

A meek nod. "Safety first, that's my motto." Then she peered at me slantwise, brown eyes half hidden by her long lashes. "I'll follow you sixteen ways to Sunday if that's what it takes to make you happy." She laid a hand on my shoulder. "How about a nice cup of coffee while we're trying to get there?"

It was my turn to sigh. I had to admit that she really was going out of her way to work with me on this and avoid an off-mode-provoking fight, and the airlock was making me more than a little jumpy and short-fused. She hadn't done anything wrong, and nothing bad had happened. To us, anyway.

"Sure." I raised my voice slightly. "Sorry, regrets to the Nakamuras. Authorize and notify them of a hazard bonus."

"Acknowledged."

"You're a nice man, Dave," Gloria purred approvingly. "Just for that I'll make sure you get a clean cup."

While she went to pour, Anna and Manny brought chairs over to the terminal, doing their best to look serious.

"So how does this horrible thing work?" I asked, once I was sitting down with a covered cup of coffee in my hand.

Gloria sat down next to me. "To begin with, the enties are derived from M-M's own version of Hydrofilm."

Water is a fairly scarce, quite valuable commodity on Luna. And yet most downs have a swimming pool of some sort.

This isn't quite the extravagance it

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might seem at first glance. It's a fairly handy way of storing some of your reserves and yet still getting use out of them. Its presence is reassuring to creatures evolved on a watery world like ours. A pool offers recreation, exercise, and a community focal point with games and events like Wimmens' Night and the Teen Splash. Swimming is something families can do together here not too differently than back on Earth.

But because of the lowish air pressure most downs maintain, evaporation can be a bit of a problem.

Protecting an open water source is not a problem unique to the Moon. Seeing potential markets both on and off Earth, a company named Sentiease developed and sent us for testing something they called Hydrofilm.

It wasn't really a film. It was a strain of enties designed to interlock with each other tightly enough to keep water molecules from passing through. The control unit that came with it instructed the enties to maintain different levels of cohesion. They could be made to bunch up and uncover the surface completely, or hang together tightly enough to keep small objects out—a setting which would keep bugs and other airborne contaminants out of a reservoir—but let a swimmer or diver pass through unimpeded. The increased surface tension also helped damp down the waves and splashing, once again a problem in low *g*.

That was the way Hydrofilm was supposed to work, and that's the way it did work until Frankie Jeffers, age sixteen, Red Cross certified swim instructor and lifeguard, and a full 10 on the Jameson Scale, laid hands on the control unit.

Sorry has a running program to passively watch for anomalous activities. He called me, and when I got to the pool I found Frankie and his swim class gleefully bouncing up and down atop the water, the abnaddled Hydrofilm having turned the pool into a giant trampoline.

This story illustrates another reason companies willingly pay the heavy freight it takes to have their products abnotech tested. The Serendipity Factor.

Sentiease took Frankie's discovery and ran with it. This led to a whole new fuel and water storage technology, self-sealing hull coatings for ships and boats and tankers, and a hundred other spinoffs. Other manufacturers started working on their own versions of Super-hydrofilm, but Sentiease was there first, and grew from a smallish maker of industrial/commercial NT products to one of the Big Kids on the Block by the time they got there.

Frankie's bonus was big enough for him and his family to retire on, but they're still here.

Because it's home.

And because not one in a hundred of us wants to risk the trip back to Earth.

One hour and two cups of coffee later I was about ready to pull on a pressuit's helmet. Once again Leak's Law had proved itself; only moments after I suited up, I had to take one. I was going to make myself wait, the

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suit's grimly functional facilities being what they were.

Gloria and I had argued about this, of course, me insisting that as Chief Safety Officer and one of the ten most cautious people in Crater Billy it was my duty to be the first one to test this new airlock. She wanted to do it because she's Testing Chief and believes herself to be indestructable.

I finally won, but it was pyrrhic victory that left me feeling more like a wiener who had volunteered for the fry pan, bun and mustard treatment, than a winner.

"All you have to do is walk through," Gloria assured me once again. "The enties are progged to part enough to let you out, yet stick so close to each other and the intruding surface—that's you, my sweet—that no air escapes at the same time. The hole your body creates will close up behind you like it was never there. Now remember, there will be some resistance, so be ready for it."

I was already in resistance, so I guessed I was as ready as I'd ever be. "I will," I promised, picking up the helmet.

"We've put a good setup together, Dave. There shouldn't be any problems even if something goes wrong."

She was theoretically correct. I'd insisted that the outer chamber's door be closed and locked, and that Gloria, Manny and Anna suit up in case the lock failed, even though worst-case pressure drop probably wouldn't cause anything worse than earaches and maybe a nosebleed or two. She'd continued to go out of her way to stay on my good side, agreeing with every precaution.

"Once you're on the other side, go to the terminal at the far end of the room. All you have to do is type in your name. The time, date, your rating, and all the rest will be logged automatically."

"OK." I pulled my helmet on and locked it onto its ring. It all sounded easy enough, which of course only increased my gut-level conviction that it probably wouldn't be.

"Commcheck," Gloria's said over my suit's radio.

"Loud and clear," I answered, Anna and Manny echoing me.

"Then let's begin." If she were only this businesslike all the time we'd *fight a lot less. At least while we were* working. That's not what a man wants to hear a woman say before lovemaking. Makes it sound like a test or something.

I took a deep breath, a totally pointless exercise in a pressuit. "Here goes nothing."

Up close the surface of the lock looked even more like a finely woven metallic cloth, a macro effect of the microlattices the interlocking enties formed. Gloria had called it a "smart solid." I preferred the dumb kind.

I'd spent part of the two hours between when I'd first seen the thing and this visit having Sorry soothe me with statistics on Mercedes-Motorola Microwerks. They were tied with Blafrica NT and Little Josie's Tiny Critter Factory for the lowest rate of flakiness in devices we tested. Not one single injury could be laid to their account.

Hoping I wasn't the first, I reached out my gloved left hand—the fingers

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I figured I could most afford to lose—and touched the lock's surface. It felt firm, yet with an inherent give to it, something like human flesh. I found it kind of creepy.

"How's it feel?" Gloria asked. She was standing right behind me, ready to drag me back if it tried to eat me. If you don't think that's possible then you're not an abnotech who has tried to go through a revolving door or use an elevator.

"It's kind of, um, strange. I feel resistance, but the harder I push the more give there is, and it—oh. . . ."

The surface *gave* and my gloved hand slipped into the black stuff fairly easily, like it was something thick but not solid; a bucket of honey for instance. I felt my fingers come out on the other side. "How thick is this crap, Gloria?" I asked in a reasonably calm voice.

"Four centimeters. According to the documentation one centimeter would be more than adequate, but until the material completely proves itself the Merc-Mola engineers are being their usual overcautious selves." She raised her voice slightly. "Manny?"

"He's had his hand through for thirty seconds. Surface deflection of the lock in the unopened areas hasn't changed. Inside and outside pressures are stable to six decimal places. It's like he had his hand stuck in a solid wall."

"Thanks, Manny," I muttered, pulling my hand back slightly to make sure I didn't.

"Anna?"

"His vitals are high but nominal. No excess fluids in his suit legs. The sniffer inside has picked up a few more air molecules, but only in the PPB range. Too few for a leak. More likely it was air trapped in the weave of his glove."

"Excellent. Keep monitoring. Well, Dave?"

"Yeah, sure." There was no point in just standing there like the Little Dutch SpaceBoy. Taking another absolutely pointless deep breath I pushed my arm all the way in and through, then followed it to the other side.

It was like walking through a wall made of thick licorice goo, the stuff sticking tight to me as I went into it. Everything went black as it plastered itself to the faceplate of my helmet, but it peeled right off again a moment later. My movements were slowed, as if moving under extra thick water, but I wasn't really hindered as long as I kept moving.

"I'm through," I said, turning back to look. There was no sign there had ever been a me-sized hole in the black surface.

"Well?" Gloria asked impatiently.

I still didn't like the thing and doubted I ever would. "It didn't blow up or out," I answered, half surprised, half relieved, half disappointed. "Yet, anyway. How much air did it let out with me, Anna?"

"The amount's barely measurable, Dave."

"OK." *So's the failure rate of those tabletop display terminals,* I said to myself. *But now I know that Cindi has a tiny green dragon tattooed in a*

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spot I've never seen, not even when she wears that skimpy topless thong bathing suit of hers.

"If anyone can cause a slow leak or weak point or something similar in the lock, it will be one of us," I said, stating the obvious. "I want pressure, air transfer, deflection—the whole nine yards—monitored constantly. Automatics and alarms are OK, but I want human verification and notation every half hour."

"Check," Gloria answered agreeably. "Make it so, guys." The fact that she was already monitoring these things suggested that she'd expect me to want such precautions. I wasn't going to disappoint her.

"I'm heading for the terminal now," I said, knowing she was watching me on the video feed anyway.

It was at the far end, the oversized keys on the suit-adapted manual board easily worked with gloved hands. I punched in my name, the letters appearing on the screen above the keyboard, then cautiously hit ENTER. That's a habit most abnotechs have. Hitting that particular key is always a diceroll.

The display changed to read:

JTL/CBTO TEST SERIES #1 OF MERCEDES-MOTOROLA NT-BASED AIRLOCK. SUBJECT DAVE WATSON MURPHY, JTR 7, ARE YOU IN TROUBLE?

A bland, mechanical voice recited these same words in my helmet. It had even gotten my name right. I tapped the NO bar. THANK YOU, it replied. YOUR WORK ACCOUNT WILL BE CREDITED FOR PARTICIPATING IN THIS TEST. YOU MAY NOW EXIT THE TEST CHAMBER. THE STAFF MEMBER OUTSIDE WILL ASK FOR A VOICE VERIFICATION TO PROVE YOU SUCCESSFULLY EXITED THE DEVICE BEING TESTED. PLEASE GIVE IT, OR YOUR PAYMENT WILL BE VOIDED. HAVE A NICE DAY.

"You too," I told it, watching the screen expectantly. IT'S ALWAYS A NICE DAY WHEN YOU GIVE ME INPUT, DAVE, AND I'M SO GLAD YOU WERE THE FIRST.

Just like I'd thought, that damned Gloria had *known* I'd insist on testing the lock.

As I said before, we knew each other all too well.

Half an hour later we had our pressuits off and were working on another round of coffee while finalizing the test protocols.

"All right, Anna," I said, "Read them back. I want to make sure I didn't miss anything."

"OK." She peered down at the screen of the pad on her lap. "'At least one test oversight tech is to be on duty here at all times. If not, the chamber must be under full security lock. The outer door is to be closed during testing, but need not be locked. The on duty tech must be wearing a pressuit when nonstaff people are testing the lock; the helmet need not be worn, but must be within easy reach. Monitoring of surface deflection and int-ext pressure will be automatic, with manual verification every half hour. Double redundant sniffers in the evacuated chamber will be active at all times, auto/manually monitored and set to maximum sensitivity to scan for leaks pressure readings might miss.'" She looked up from her pad and grinned at me. "Rubber Bend worry you,

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Dave?"

I had relaxed enough by then to grin right back at her. "You bet your ovaries it does, Anna."

Looking at the computer records through the lens of Jameson's discovery had turned up all sorts of interesting information. One juicy bit was that heterosex pairings where at least one partner had a rating of 7 or above had a pregnancy rating higher than the statistical norm. The reason? Failure of birth control, of course—especially barrier methods. The datasucker who had stumbled across this bobbleup in the graphs had dubbed it the *Rubber Bend.*

She went back to reading. " 'No youths under the age of ten will be allowed to test the lock unless accompanied by an adult guardian. In such cases where such youths are testing the lock, both the guardian and on-duty tech must be in full pressuit and helmet. Passive monitoring for emergencies and anomalies will be carried out by Crater Billy's AI at all times, notification of an emergency sent to CSO Dave Murphy, DSO Jeff Handel, CTO Gloria Lunden and CMO Dr. Bob Ross if a Code C or above.' That's it. Anything else?"

I looked over at Gloria. She was slouched back in her chair watching me, a feather-mouthed cat's expression on her face.

"Not that I can think of at the moment." Her smile got wider and a little smug. "—But I'm sure I'll come across other gaping holes in your methodology which will have to be patched."

By the look on Gloria's face you'd have thought I'd given her roses. There were times I wondered if she regarded me as an especially quirky and troublesome device for her to work on.

I stood up. "Post and implement the rules and you can begin testing. I'll be checking up on you every so often, so don't get lax." I headed for the door to let them get on with it, and let me go back to my office and fix a stiff drink. It was still early, but it had already been a long day.

"Don't forget that you've got a hot date tonight," Manny called as I reached the threshold.

"And remember, the Rubber Bend never sleeps," Anna added with an evil chuckle.

I hoard food.

Most of us here in Crater Billy do. We also tend to maintain personal supplies of bandages, pain pills, candles, battery lamps, and emergency air and water bottles. Almost every abnotech here owns his or her own personal crowbar. If you had our luck with powered doors you would too.

We had been testing quite a few commercial and consumer food transformers. They were a hot item then—and still are—because they theoretically provided an easy way to transform such cheap and readily available—if completely unappetizing—components as basicalgae, fungamax, yeastmeat and sewage grown aquasoy into something edible and even occasionally tasty. But as the Detonating Limburger Mishap illustrates, some models weren't quite perfected yet.

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Figuring I'd used up my luck for the day testing the airlock, I played it safe with that night's dinner and assembled a pizza from frozen, fresh and stabilized components. Gloria showed up just as I was putting it into the oven, a Jameson-tested electric I could trust as well as I could trust anything.

I checked the pie every five minutes until it was done. We ate by candlelight, washing it down with a nice synthetic red wine made right on Luna from materials that didn't bear too close examination, syrupy orchestral versions of the whakmuzik popular in our youth playing in the background. Very cozy and romantic. We made a point of not talking about work.

Jeff was on duty as Safety Officer, but I was still on call. So was Gloria. Being dedicated professionals, we left our wristlets on. But before we got to the point where that was all we had on, I went around and covered every video pickup in my cubby.

As Ted and Cindi had proved just that afternoon, many accidents happen right in the home. I didn't want us to become another statistic.

Again.

Time passed, the days piling up like paperwork in the Out Basket of Life.

I was busy with the usual disasters and near-disasters, test speccing, report review and the rest of the pulse-pounding minutiae of a Safety Officer's life.

Gloria and her crew were testing dozens of items other than the airlock, but we both kept a closer eye on that project than any others. Me because I didn't trust it, her because she was fascinated by the damn thing.

One thing I've always had to give her. When she tests something, she tests the living *hell* out of it. Testing had been going on around the clock since day one, and at the end of three weeks well over a thousand trips had been made through the lock. Billyites had used it singly, in pairs, even three 10's at once. She had abnotechs stand in the middle of the entie barrier and make calls on their suit radios, play with hand-held games, work pads, and operate kitchen appliances. She herself had stood there mid-barrier and powered up a restricted usage wideband entieprogwiper.

When people weren't going through it she and her staff shot first rocks and then bullets into the barrier, squirted the control pad with soft-drink, whiskey, solvents, boiling water and liquid nitrogen. She ran a big piece of pipe through it, then taped twelve chairs together and ran them through to see if something that long would confuse the thing. When it didn't, she tried it with a conga line, complete with musical instruments.

The lock performed flawlessly every time. Only once did it do something unexpected. That was when she tried to throw a bucket of water through it.

The water came out the other side as a smooth black eight-liter balloon, the liquid coated with a thin layer of enties. Since the lock enties were distantly related to Hydrofilm type enties this made a certain amount of sense.

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I came in to consult with them on this one, but couldn't see how it could cause a safety problem unless someone shot a firehose through it long enough to take away enough enties to weaken the barrier past the point where it would hold pressure.

Gloria, Anna and Manny put their heads together for a few minutes, and shortly afterwards they tried just that.

An hour later the bottom half of the evacuated chamber was filled with a bulging black sack of water, and the barrier was still well over three centimeters thick. Manny reported a slight rise in resistance as the barrier thinned. Sorry extrapolated the trend and predicted that the lock would become completely impermeable before it thinned to the two-centimeter mark.

When we brought that first water balloon back in to examine it the enties reabsorbed themselves into the lock itself, and it turned back into a bucket of water—sans bucket—in Gloria's hands. We wouldn't have been able to run this test if Anna hadn't figured out how to run a hose through the lock and into the water bag to pump it dry.

The plan was for the testing to continue for ninety days—longer if there was some sort of mishap. That had evolved into the rule of thumb for abnotech testing. If an item didn't go abnanas in that period of time then it was probably perfectly safe for the general public.

The mishap occurred at 1:19 AM local of day 43.

* * *

At this point Gloria and I were still together. Normally before a month had passed we'd have some sort of fight that knocked us off on mode. Our working relationship was always ready to provide that kind of dealbreaker. Even if we somehow avoided that pitfall there was another argument cycle we'd repeat, a variation on our working relationship.

We are two very different people. I like things stable and certain, with identifiable rules and goals. Gloria gets bored easily and resists commitment. What I find comforting, she finds confining. The more seriously I'd treat her and our relationship, the more she'd treat it—and me—as a joke. Friction would build. The process had started again, but hadn't reached the blow-up point yet.

43 days together was an all-time record for us.

Records are, as they say, made to be broken.

I was spending that night with Gloria in her messy cubby at one end of the Testing section. She'd gotten all heavy-eyed and yawny not long after dinner and gone to bed early. I read and ignored the tube until almost midnight, then turned in myself. She never stirred when I crawled under the covers beside her.

We were both sound asleep when just over an hour later our wristlets began to shrill the emergency signal and Sorry's voice came blaring from every output device in the cubby.

"CODE 1 EMERGENCY WITH AIRLOCK TEST! CODE 1 EMERGENCY WITH AIRLOCK TEST! CO—"

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"I hear you!" I yelled, trying to get out from under the arm Gloria had flung over my chest and sit up. "Report!" Beside me she groaned and stirred groggily, more asleep than awake.

"It's Jenny Montez! She's in the test chamber and I think she's choking to death!"

"*Oh God no,*" I whispered, kicking the covers aside and leaping out of bed. Behind me Gloria was trying to struggle to a sitting position with a drunken slowness. I wasn't going to wait around for her to get her shit together. "Did you Code 1 Bob and a medical team?" I asked as I bolted for the door.

"I'm *trying!*" He wailed, sounding as desperate as I felt. By the time I reached the cubby's front door he had it already open for me.

"What about the tech on duty?" I demanded as I went out the door and started running down the corridor, barefoot and bareassed. Staying at Gloria's had been a stroke of luck. The test chamber was barely a hundred meters away.

"He doesn't respond to the alarm!" I could already hear it in the distance.

Vowing to have the duty tech's head on a platter I ran as fast as I could, not even wasting breath on cursing. Crater Billy is like a small town. You know all of your neighbors. Jenny Montez was eleven years old, a 7, the only child of Pete and Luz Montez, and too goddamned young and pretty to die.

Once again Sorry already had the door open when I reached the outer test chamber. I flung myself inside and tried to get a handle on the situation.

I recognized the testing-tech on duty. It was Gabriel Delaney, a fussy, waspish black number-cruncher I'd worked with several times before. Ex-army and a real stickler for rules, he was about the last person I'd have ever expected to find asleep at his post.

But there he was, suited up without his helmet, sacked out in a chair with his cheek resting on its neck-ring.

The alarms were deafening. I might have tried to wake Gabe, but decided if he could sleep through that racket he could sleep through anything.

"*Cut the damn alarms!*" I bellowed, whirling around to look at the screen which had been set up so the tech on duty could monitor the reads and observe what was happening in the vacced chamber.

The alarms died.

Something like a small sharp sliver of death pricked my heart at what I saw on the screen.

A small pressuited figure lay face-down on the stone floor near the terminal at the far end, its arms and legs twitching spastically. The helmet's faceplate was turned away, but it didn't matter. I could see Jenny's face all too clearly in my mind.

I wasted a couple precious seconds looking at and thinking about the spare pressuits racked on one wall. There was no way in hell I could get into one in less than a minute.

It was then that I saw the fatal flaw I'd left in the test setup. There was no fast, easy way to manually dump air into the other chamber—at least

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that I could think of right then. The enties could be reset to let air though, but only slowly. *Too* slowly. The lock couldn't be simply shut off while there was a pressure differential on either side. For safety's sake.

I'd known all along that vacuum was the enemy.

I turned to face the lock, took a deep breath, lowered my head and ran full tilt at the shimmering black wall of the airlock.

"*Dave!*" I heard Sorry yell. "What are you do—"

I never heard the rest. I remember thinking *you got my name right!* with a sort of detached amazement, then everything went black as I hit the barrier.

It was like running into a wall of thin glue, that weird feeling of resistance sweeping over me, all the more acute this time because I was stark naked.

Then it sort of *gave* and I was through.

I came out off-balance, stumbled and fell, landing badly and feeling something give in one leg. I lost half of the air in my lungs to a scream the vacuum ate soundlessly. The next thing I knew I was curled on my side on the floor. I was blind. The only thing I could hear was the thump of my heart slamming blood against my aching eardrums. My whole body felt strange and numb, all except for one leg. That felt like it had been chopped off at the knee and the stump nailed shut.

You've killed yourself, stupid! I thought, but clung to the hope that dying would take long enough to let me save Jenny.

I couldn't stand on my messed up leg, so I began scrabble-crawling blindly toward the other end of the chamber on two hands and one knee, every motion setting off a fresh firework of pain in the other. Other than that hotspot I was cold, and getting colder by the second.

After what seemed like forever I stumbled across Jenny's body.

My lungs were on fire as I ran my hands over her to see if she was moving—she wasn't but I did think I felt a faint heartbeat through the material of her pressuit—and to orient myself. Then I got turned around with one arm around her chest and started dragging her back toward the lock.

I was blind. The pain in my leg was trying to steal whatever little breath I had left, and my head was spinning so badly it was a wonder I didn't just go in circles.

I lost my grip on her and crashed into one of the side walls, bashing my head and giving my bad leg another twist. I came within an ace of fainting, but somehow held on.

Several panic-stricken seconds of groping blindly around later I found her again. Hooking my fingers under the cold metal of her suit's neckring I dragged her forward another few centimeters. Then myself. Then her. By then I was beyond remembering where we were going. All I knew was we had to get there.

To this day I don't know if I would have made it or not. Saying I doubt it is giving it the benefit of the doubt.

What I do know is that suddenly I

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was scooped up off the floor, then gently parked on a wide hip like some women carry their children and pressed tight to soft warm flesh.

Mother? I thought crazily, wrapping my arms around my rescuer's body and holding on tight with a combination of animal instinct and absolute desperation.

Whoever held me bent down. My messed-up leg hit the floor and twisted off sideways. I would have screamed, but the arm cradling me kept my face pressed up against warm fragrant flesh, stoppering my mouth.

So I fainted instead.

When I came to again I wasn't dead. I have to rate this as one of the nicest surprises of my life.

I opened my eyes to bright strip lights and that alcoholy smell which spells *infirmary*.

"The sleeper wakens," said a soft voice beside me. I turned my head. There was Gloria standing beside the table I was on, a fuzzy blue blanket wrapped around her broad shoulders.

I said something witty like "Urg." My brains were slowly reassembling themselves and my thought processes rebooting, but I wasn't quite up to coherency yet.

Then an instant later one part of the operating system went back online. "*Jenny!*" I gasped, trying to sit up.

Gloria put a hand on my chest, holding me down. "She's OK, Dave." Her touch was gentle but irresistable. "She's in the next room. Bob got to her in time. She'll be just fine."

I let my head fall back, the events which had brought me to this point doing a fast replay in my head. They got pretty iffy toward the end. "What—what happened?"

She smiled and stroked my cheek. "You saved Jenny."

"What happened to her?"

She chuckled. "A more severe form of what happened to me, Gabe, Bob, Jeff, and a whole lot of other people who had the same thing for dinner."

"Dinner?" Either she wasn't making sense or I'd sustained brain damage.

"Dinner," Bob said, coming in to stand beside Gloria. He looked tired but pleased. "We all had the pot pies made with food transformer turkey."

"That damned Kentford unit?" I asked. Gloria nodded. "You mean the stuff it made was poisonous?"

Bob made a face that was half pained, half amused. "I think *skewed* would be more accurate. The turkey it produced contained over five times the normal amount of *L-tryptophan*, the enzyme in turkey meat that can make you feel logy or sleepy after eating it. Most of us who had pot pie were sedated to one degree or other."

"I had liver," I said. I don't like it, but had always figured it was good for me. This proved it.

Bob smiled ruefully. "Not me. I had seconds on the pot pie. Jeff almost had to drag me out of bed and keep kicking my butt to keep me moving. It turns out Jenny has a sensitivity to the enzyme. Normal concentrations wouldn't have bothered her, but she's a growing girl and had two big helpings at dinner and went back for a third later on. The thing is, children

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don't always react to things the same way as adults. In her it first brought on hyperactivity and insomnia, which is how she ended up going for a midnight snack of more turkey pie, and then killing some time by testing the lock in the dead of night. That third helping took her over a threshold and brought on nausea after a while. Her body's purging itself of what was giving her trouble would have been fine, except that she was in a pressuit and helmet. You know what happened then."

I shuddered and nodded. "She started drowning in her own vomit." That's a particularly ugly way to die.

He patted my shoulder. "Hey, thanks to you we got to her in time." He looked me straight in the eyes. "You know, not many people would've been brave enough to go into full vacuum buck naked to save someone."

"I think stupid is a lot better word. Besides, I didn't last long enough to save her. Someone else had to save the both of us." I looked back up at Gloria. "You, right?"

She shrugged. "You weren't that far from the lock," she said, avoiding my gaze. "I'm sure you would have made it."

"You're a terrible liar." I shook my head, remembering. "I was suffocating, crazed with pain, half-conscious, so dizzy I didn't know which end was up, and blind as a bat in the bargain." I frowned, suddenly confused. "I was blind in there. I figured the vacuum had wrecked my eyes. How come I can see just fine now?"

She finally met my gaze. "You don't know?"

"Know what?"

Her face broke into a pleased smile. "No, you never saw it, did you?"

"Saw *what?*"

"You can see for yourself." She raised her voice slightly. "Sorry? I know you're there."

"I am, and I'm glad you're all right, Dove."

"It's Dave." It looked like things were back to normal.

"You be nice to him," Bob warned. "It was Sorry who spotted the pattern in who was acting groggy and told me to check for L-tryptophan."

"Thank you very much, Sorry," I said formally. "You can call me Dove anytime."

"I probably will," he admitted sheepishly. "So what did you want, Gloria?"

"I'd like you to replay the video record of what happened from the moment Dave entered the outer test chamber. Do a split, showing both inner and outer chambers at once. No sound."

"No problem." There was a meter wide screen on the wall facing the examination table. It lit, and after a second the left side showed me running in the door and skidding to a stop, wild-haired, wild-eyed, and naked as the day I was born. The look I gave Gabe could have killed, then I turned to stare at the screen he was supposed to be watching, all the color draining from my face. I gave the slightest shake of my head as I looked at and rejected the pressuits. A second or two later I was running toward the airlock, arms and legs

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pumping.

"Watch close now," Gloria said beside me.

I hit the lock, slowing suddenly as I disappeared into it.

The right side of the screen showed me toppling out the other side—

—covered from head to toe in shiny black.

"The human body is largely water," Gloria said quietly as on the screen I fell, my right leg going off at an angle it had never been designed to bend into, steam shooting from my mouth as I screamed. I winced, remembering how it had felt. At the moment it was blessedly numb.

"You tore hell out of your knee there," Bob put in, adding his own bit of medical color commentary. "You're going to be in a cast at least a month."

The black-coated me began crawling blindly forward, dragging one leg behind me. I could see that my eyes had been open and staring, but they were covered with the same coating of enties as the rest of me. It made my eyes itch and water thinking about it.

I can't say that it was very enjoyable watching myself scrabbling like a gimpy tar-covered crab toward where Jenny lay. Gloria slipped her hand into mine. "Pretend it's a movie," she whispered. "There'll be a happy ending."

As painful to watch as that had been, watching myself struggling to drag her back was even worse. I held her hand even more tightly.

Fortunately something easier on the eyes appeared on the left side of the screen. It was Gloria, finally catching up with me. She was nude and magnificent. I was naked, she was nude. I couldn't have told you what the precise difference was, but I knew it when I saw it.

She went through almost the same routine as I did; eyeing Gabe, taking in the situation on the monitoring screen, glancing at and rejecting the pressuits.

But instead of taking a kamikaze at the airlock the way I had, her gaze went back to the screen. Her eyes narrowed in calculation, and I could almost hear her brain revving up like like a batch of superprocessors given a particularly knotty problem to solve.

I had managed to drag Jenny maybe a meter and a half by then, and was in the process of losing my grip and crashing into a wall like an ant with malfing antennae.

Gloria's gaze swept the chamber like a scanning beam, locking onto the white box by the outer door, her body following after a second later.

She snapped the box's door open so hard it's a wonder it didn't come off in her hand, reached inside, then pulled out an emergency breather mask.

"Now why didn't *I* think of that?" I muttered darkly. "Some safety officer."

Gloria squeezed my hand tightly as on the screen she pulled the mask on and triggered the air cannister. "I had more time to think. That, and I'm a whole lot smarter than you." I shot her a dirty look. She just grinned.

The Gloria image was heading for the lock now, moving as fast and full

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of purpose as she ever had on the football field. Lowering her head, she put her arms out in front of her like a diver entering the water and plunged into the shimmering black wall.

She came out the other side all glazed in black like an animated sculpture covered with powdered obsidian.

But not completely covered. Her face was visible. The enties went right up to the rubber seal of the breather mask and stopped, leaving its clear plastic faceplate bare.

I got it then. I'm not usually so slow on the uptake, but I'd had a rough night.

"How did you know it would work like that?" I asked.

She shrugged, her blanket slipping in an interesting manner. "Logic. I'd seen the one part of you that wasn't covered by enties."

I studied the screen image of myself dragging Jenny forward centimeter by centimeter, my fingers hooked in her suit's neckring. Then I saw it. My wristlet, winking in the light as I moved. It was made of metal and plastic, like some suit parts, not overcomplicated water, like skin.

Had I been able to see Gloria coming for me I probably would have broken down and cried. She swept down on Jenny and me like a statue of a goddess come to improbable life, stooped—

"You picked me up first." I remembered it then.

Another shrug. "You were closest."

Maybe so, but I could see the look on her face as she picked me up like I was no burden at all, parking me on one round hip and gathering my face to her breast with one arm. Once she had a good grip on me she bent and gathered Jenny up with her other arm. I stiffened when my leg hit the floor, then went limp.

Once she had both of us she headed back toward the airlock. She moved quickly, but with tightly controlled speed. Looking at her face and her posture I got the feeling that if that lock had somehow turned to solid concrete it wouldn't have slowed her one iota.

Into it she went . . . emerging into air. The entie bodysuits, which covered both of us, melted back into the barrier as we went through, leaving me naked and her nude again.

Jeff, Anna, Bob and three of his medical people were waiting for her. The went into action, taking Jenny and me away from her and beginning work on us even as they lowered us to the floor.

Gloria stood there, watching intently.

Watching them work on me.

After a moment she peeled off her facemask.

"End replay, Sorry," she called. The image froze, faded.

But she hadn't stopped it soon enough. I saw.

Tears in the eyes.

In the face of a woman who took how she felt about me very seriously indeed.

That all happened exactly one year and two days ago.

One reason I remember the date so precisely—and don't dare forget

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it—is because we were married two days later. Her all in white—like anyone was going to tell her she couldn't wear it—and me in a tux with one leg shortened because of my cast. Jenny was Maid of Honor, Jeff and Bob Best Men. Gabe, who had been sleeping-potioned by the same turkey pies which had nearly killed Jenny was ring-bearer. Sorry conducted the ceremony. He even got my name right.

I just got done talking to that moron Binkovitch.

We're supposed to begin testing the new self-suiting airlocks in about five days. I'm forced to admit that the concept has some merit; the original lock enties have been modified so all you have to do is walk out the lock wearing a breather mask. No matter what you're wearing—or not wearing—it suits you up as you pass through. The entie coating is also supposed to make regular and construction grade pressuits safer by making them self-sealing. Once again, a concept with some merit.

That ferret-faced weasel Binkovitch says they're foolproof.

My darling wife can hardly wait to get her hands on them and begin testing.

Me, I hate them already.

We'll fight about it, sure as my name's Dove Murphy.

There are some things you can't expect marriage to change. Not if you want it to work. ■

(Biolog continued from page 215)
of this magazine, with two more the following year. She had been warned that she should use first-name initials so the editor wouldn't know she was a woman.

That editor was the legendary John W. Campbell, Jr., who not only didn't care that she was a woman, but on their first meeting skipped the usual male waste of time telling her how cute she was and went right into a hammer and tongs debate over the ideas in her stories. She had tried hard to come up with what she considered the essence of good science fiction: not the plot, nor the characters, but an original idea convincingly developed. Her first story centered around people having hidden telepathy they're not aware of, mediated by the subconscious. Her second story was about the design of space stations and a way to save fuel by slingshot turns around moving gravity wells. A third story was about people gaining youthful immortality and becoming so careful they cower in locked rooms breathing through filter masks. Then came a story about a tailored retrovirus that caused a universal plague that relieved the population pressure.

Always a free spirit, she happily lived the flower-power way of life during the fifties in New York's Greenwich Village, the sixties in San Francisco, and the seventies in Portland, ME. She published her last novel in 1975 and stopped writing when she found sitting at the desk too wearisome. Equipped now with a lap-top computer keyboard while lounging in bed, she has started writing joyously again. The stories will be the original-idea, hi-tech, hard-science fiction Kate MacLean and *Analog* readers like so well. ■

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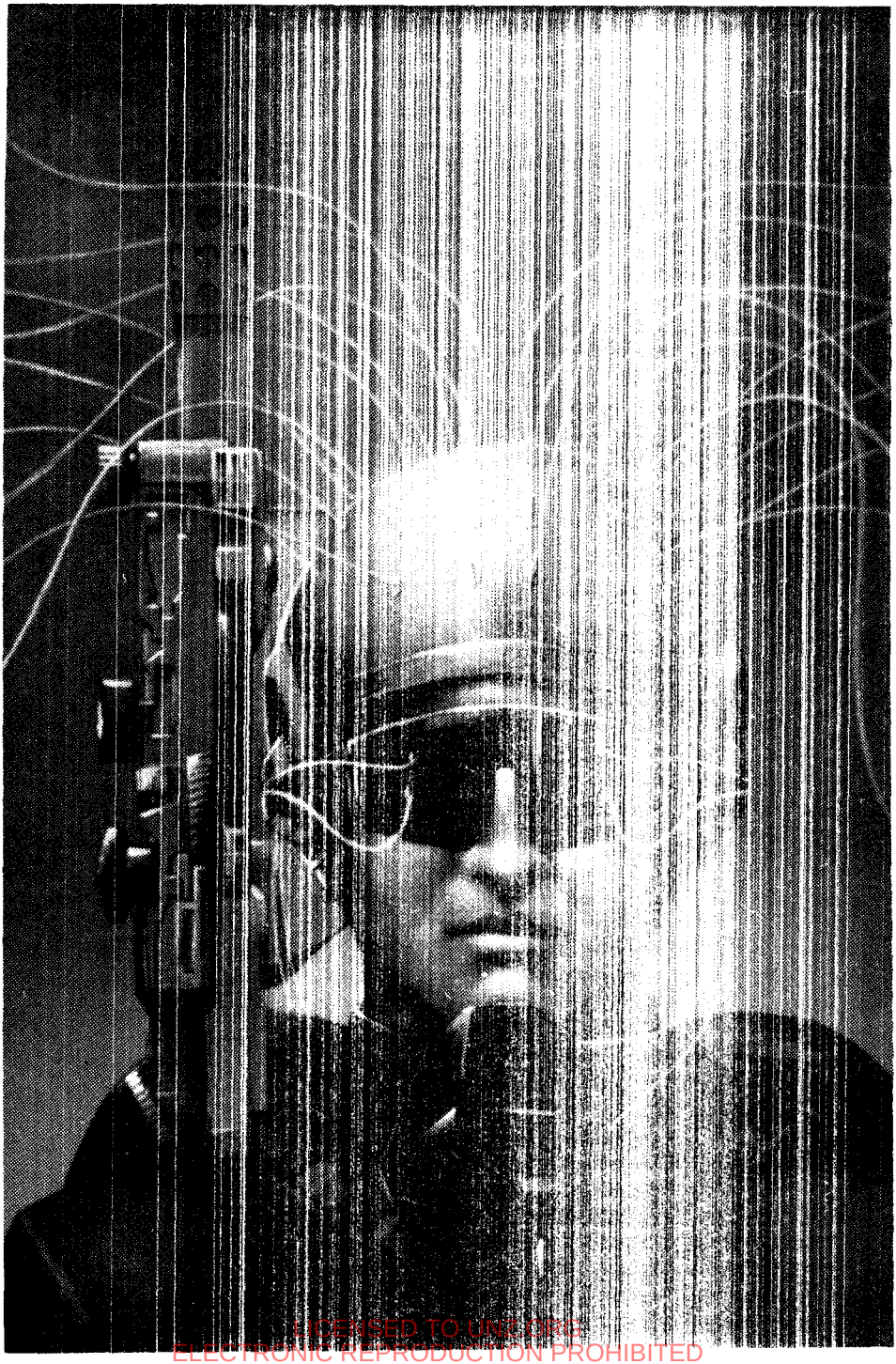

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Robert J. Sawyer

HOBSON'S CHOICE

Part Two of Four

Humans have long dreamed of two fantastic goals that at first seem very similar. But are they really?

Illustration by David Cherry

Synopsis

December 2011: Detective **Alexandria ("Sandra") Philo,** *thirty-six, of the Metropolitan Toronto Police is in the hospital dying from radiation damage inflicted by an illegal weapon called a beamer.* **Peter Hobson**, *Ph.D., forty-two, president of Hobson Monitoring Limited, a biomedical engineering firm, bursts into her hospital room. Sandra is shocked: she believes Peter, a prime suspect in some recent murders, is the man who arranged for the attack that has mortally wounded her. Peter protests his innocence and tells her of a new technique, pioneered by Peter's best friend, artificial-intelligence specialist Dr.* **Sarkar Muhammed,** *to scan every neural net in a human brain and produce an exact duplicate of the subject's mind inside a computer. Using this technique, Peter says that three computer duplicates of his own* ***mind*** *have been created—and one of them, he claims, was responsible for the murders. Even though Sandra is dying, Peter says there's still a way for her to catch the murdering simulation.*

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Flashback to January 1995: Peter Hobson is now just twenty-six, a biomedical engineering student whose course work requires him to log some real-world experience with medical monitoring equipment. He's given the chance to operate the EKG during an operation to harvest for transplant the heart of a teenaged boy who had been in a severe motorcycle accident. But during the harvesting procedure, the supposedly dead boy gasps on the operating table.

Peter learns that bodies to be used for organ harvesting are never taken off life support. He realizes that in a very real sense the teenaged boy didn't die until the moment the transplant surgeon removed his heart from his chest.

Flash-forward to 2011: To this day, Peter is haunted by nightmares about the supposedly dead boy waking up on the operating table. Because of this, he's been working on a supersensitive EEG that he hopes will be able to precisely determine the actual moment of final, irreversible death. Meanwhile, Peter has also become intrigued by a new nanotechnology process that claims to provide practical immortality for human beings.

Peter is now married to a woman named **Cathy,** *who, although she has a degree in chemistry, works in a noncreative position for Doowap Advertising. Out of the blue one day, Cathy tearfully confesses to Peter that she has slept three times now with a loutish office Lothario named* **Hans Larsen.** *Peter is devastated, crying for the first time in decades. Cathy goes for counseling, and learns that her infidelity might be the result of the cold, uncaring upbringing she'd had at the hands of her father,* **Rod Churchill,** *now a retired gym teacher.*

Peter tests his superEEG on **Peggy Fennell,** *a woman dying of old age, and discovers to his astonishment a complex, cohesive electrical field moving through her brain, and departing from it at the moment of death. He shares this discovery with Sarkar, who immediately accepts what Peter has been having difficulty believing: that the electrical field was in fact Peggy's soul. Peter has found the first scientific proof for some form of continuing existence after death.*

PART TWO
Chapter 11

September 2011

Peter hadn't seen Colin Godoyo in months—not since the seminar on nanotechnology immortality. They'd never really been friends, at least Peter hadn't thought so, but when Colin called Peter at the office asking him to come to lunch, something in Colin's voice had sounded urgent, so Peter had agreed. Lunch couldn't go on endlessly, anyway—Peter had a meeting with a major U.S. client at 2:00 P.M.

They went to a little restaurant Peter liked on Sheppard East, out toward Vic Park; a place that made a club sandwich by hacking the turkey breast with a knife, instead of slicing it thin on a machine, and toasting the bread on a grill so that it had brown lines across it. Peter never thought of himself as particularly memorable,

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but it seemed half the restaurants in North York thought him a regular, even though, excepting Sonny Gotlieb's, he only went to any of them once or twice a month. The server took Colin's drink order (scotch and soda), but protested he knew what Peter wanted ("Diet Coke with lime, right?"). Once the server was gone, Peter looked at Colin expectantly. "What's new?"

Colin was grayer than Peter had remembered, but he still wore his wealth ostentatiously, and was sporting a total of six gold rings. His eyes moved back and forth incessantly. "I guess you heard about me and Naomi."

Peter shook his head. "Heard what?"

"We've separated."

"Oh," said Peter. "I'm sorry."

"I hadn't realized how many of our friends were really just *her* friends," said Colin. The server arrived, set down little napkins, deposited the drinks on them, then scurried away. "I'm glad you agreed to come to lunch."

"No problem," said Peter. He had never been good at this kind of social situation. Was he supposed to ask Colin what had gone wrong? Peter rarely spoke of private matters, and on the whole didn't like either asking or answering personal questions. "I'm sorry to hear about you two." His cliché-dispenser suggested adding, "You always seemed so happy," but he stopped himself before the thought was given voice—Peter's own recent experience had taught him to put no stock in appearances.

"We'd been having problems for quite some time," said Colin.

Peter squeezed his lime into his Diet Coke.

"We weren't really on the same wavelength anymore." Apparently Colin had a cliché-dispenser of his own. "We weren't talking."

"You just drifted apart," said Peter, not quite making it a question, not wanting to pry.

"Yeah," said Colin. He took a liberal swig of his drink, then winced as if it was a masochistic pleasure. "Yeah."

"You'd been together a long time," said Peter, again careful to keep his tone flat, to keep the statement from becoming a question.

"Eleven years, if you count the time we lived together before we got married," said Colin. He cupped his glass in both hands.

Peter wondered idly who had broken up with whom. *None of my business*, he thought. "A good long time," he said.

"I—I was seeing someone else," said Colin. "A woman in Montreal. I had to go there every three weeks on business, took the maglev out."

Peter was dumbfounded. Was everyone screwing outside of marriage these days? "Oh," he said.

"It didn't really mean anything," said Colin, making a dismissive gesture with his hand. "It was just, you know, just a way of getting a message to Naomi." He looked up. "A cry for help, maybe. You know?"

No, thought Peter. *No, I don't.*

"Just a cry for help. But she went crazy when I told her. Said that was the straw that broke the camel's

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back." Clearly, thought Peter, *everyone* had a cliché-dispenser. "I didn't want to hurt her, but I had needs, you know. I don't think she should have left me over something like that." The server came in again, depositing Peter's club sandwich and Colin's pasta primavera. "What do you think?" asked Colin.

I think you're an asshole, Peter thought. *I think you're the biggest fucking asshole on the planet.* "Hard luck," he said, pulling the toothpick out of one of his sandwich wedges and spreading mayonnaise on the turkey. "Hard luck indeed."

"Anyway," said Colin, perhaps sensing that it was time to change the subject. "I didn't ask you to lunch to talk about me. I really wanted to get some advice from you."

Peter looked at him. "Oh?"

"Well, you and Cathy were at that Life Unlimited seminar. What did you think?"

"Impressive sales pitch," said Peter.

"I mean, what did you think of the process? You're a biomedical engineer. Do you think it would really work?"

Peter shrugged. "Jay Leno says Queen Elizabeth has undergone the process: only way to save the monarchy was to make sure that none of her children ever got to sit on the throne."

Colin chuckled politely, but looked at Peter as if he expected a more serious response. Peter chewed on a bit of his sandwich, then: "I don't know. The basic premise seems sound. I mean, there are—what?—five basic models for senescence and eventual death." Peter ticked them off on his fingers. "First, there's the stochastic theory. It says our bodies are complex machines, and, like all complex machines, something's bound to break down eventually.

"Second, the Hayflick phenomenon: human cells seem to only be able to divide about fifty times total.

"Third, the smudged-Xerox hypothesis. Small errors are introduced every time DNA is copied, and at some point the copy gets so bad that it doesn't make sense anymore. Boom!—you're pushing up daisies.

"Number four is the toxic-waste theory. Something—possibly free radicals—gives your body trouble from the inside.

"And finally, the autoimmune hypothesis, in which your body's natural defenses become confused and turn upon your own healthy cells."

Colin nodded. "And no one knows which one is right?"

"Oh, I suspect they're all right to one degree or another," said Peter. "But the key thing is that Life Unlimited's—what did they call them? nannies—their nannies seem to address all five probable causes. So, yes, I'd say it's got a good chance of working. There's no way to know for sure, though, until someone who has undergone the process actually does live for a few centuries."

"So . . . so you think it'd be worth the money?" said Colin.

Peter shrugged again. "On the surface, yeah, I guess so. I mean, who wouldn't want to live forever? But, then again, it'd be a shame to do that if it meant missing out on a wonder-

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ful heaven."

Colin cocked his head. "You're sounding downright religious, Peter."

Peter concentrated on finishing his food. "Sorry. Idle thoughts, that's all."

"What did Cathy think of Life Unlimited?"

"She didn't seem very interested," said Peter.

"Really?" said Colin. "I think it sounds great. I think it's something I'd very much like to do."

"It costs a fortune," said Peter. "You been embezzling from the bank?"

"Hardly," said Colin. "But I think it would be worth every penny."

It took three weeks to get two additional recordings of the soul wave departing from human bodies. Peter made one of the recordings at Carlson's Chronic Care, the same place he'd met Peggy Fennell. This time the subject was Gustav Reichhold, a man just a few years older than Peter who was dying of complications from AIDS, and had chosen to end his life through doctor-assisted suicide.

The other recording, though, had to be made somewhere else, lest critics charge that the soulwave, far from being a universal component of human existence, was simply some mundane electrical phenomenon related to the wiring in that particular building, or to its proximity to power lines, or to some particular course of treatment used at Carlson's. So, to get his third recording, Peter had put an ad out on the net:

> *Wanted: person in very late stages of terminal illness or injury to participate in testing a new biomedical monitoring device. Location: southern Ontario. Will pay participant CDN$10,000. Terminal individuals, or persons with power of attorney for same, please apply in confidence to Hobson Monitoring (net: HOBMON).*

Peter felt funny about placing the ad; it seemed so cold. Indeed, his embarrassment probably had a lot to do with why he offered such a large fee.

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Our free Catalog of free and low-cost government booklets will very likely impress you, too.
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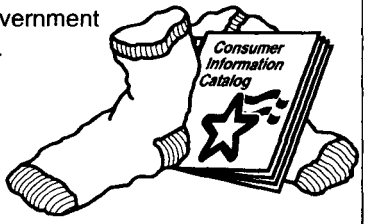

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But within two days of the ad going out on the net, Peter had fourteen applicants. He chose a boy, just twelve years of age, who was dying of leukemia. He made the choice as much for compassionate reasons as for varying the sample base: the boy's family had bankrupted themselves coming to Canada from Uganda in hopes of finding a cure for their son. The money would be some small help in paying their hospital bills.

And upon reflection feeling that the others who had already participated in the study deserved the same compensation, Peter also made a $10,000 payment to the estate of Gustav Reichhold. Since Peggy Fennell had no heirs, he made a donation in her name to the Canadian Diabetes Association. He reasoned that soon researchers around the globe would be scrambling to reproduce his results. It seemed appropriate to establish up front a generous payment for test subjects.

All three recordings looked remarkably similar: a tiny cohesive electrical field departing the body at the precise moment of death. To be on the safe side, Peter had used a different superEEG unit to record the Ugandan boy's death. The principles were the same, but he used all-new components, some employing different engineering solutions, to make sure that the previous results weren't due to some glitch in his recording equipment.

Meanwhile, over the course of several weeks, Peter had also used a superEEG on all 119 employees of Hobson Monitoring, without telling any except his most-senior staff what it was actually for. None of his employees were dying, of course, but Peter wanted to be sure that the soulwave did indeed exist in healthy people, and wasn't just some sort of electrical last gasp produced by an expiring brain.

The soulwave had a distinctive electrical signature. The frequency was very high, well above that of normal electrochemical brain activity, so, even though the voltage was minuscule, it wasn't washed out in the mass of other signals within the brain. After making some refinements to his equipment, Peter had little trouble isolating it in scans of all his employees' brains, although he did find it amusing that it took several tries to locate it in the brain of Caleb Martin, his staff lawyer.

Meanwhile, that selfsame Martin had been working his tail off, securing patent protection on all the superEEG components in Canada, the United States, the European Community, Japan, the CIS, and elsewhere. And the Korean manufacturing firm Hobson Monitoring used to actually build its equipment was gearing up a new production line for superEEGs.

Soon it would be time to go public with the existence of the soulwave.

Chapter 12

Peter felt like a student again, pulling off a silly fraternity prank involving putting clothing on animals. He made his way over to one of the cows and stroked it gently at the base of the neck. It had been years since Peter had been this close to a cow; he'd

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grown up in Regina, but still had relatives who owned dairy farms elsewhere in Saskatchewan, and he'd spent parts of his boyhood summers there.

Like all cows, this one had enormous brown eyes and wet nostrils. It seemed unperturbed by Peter touching it, and so, without further ado, he gently strapped the modified scanning helmet onto its loaf-shaped head. The beast mooed at him, but more in apparent surprise than in protest. Its breath stank.

"That it, doc?" asked the foreperson.

Peter looked at the animal again. He felt a little sorry for it. "Yes."

At this slaughterhouse, cattle were normally stunned with an electrical charge before being killed. But that method would overload Peter's scanner. So instead this particular cow would be rendered unconscious with carbon dioxide gas, hung, and then have its throat slit for drainage. Peter had seen a lot of surgery over the years, but that cutting had always been to cure. He was surprised at how upsetting he found the killing of the animal. The foreperson invited him to stay for a full tour, including the butchering of a cow, but Peter didn't have the stomach for it. He simply retrieved the special bovine headgear and his recording equipment, thanked the various people he'd inconvenienced, and headed back to his office.

Peter spent the rest of the day going over the recording, trying various computer-enhancement techniques on the data. The results were always the same. No matter what method he used or how hard he looked, he could find no evidence that cows had souls—nothing of any kind seemed to exit the brain at death. Not too surprising a revelation, he supposed, although he was quickly coming to realize that for every person who would hail him as a genius for his discoveries, there'd be another who'd damn him for them. In this case, the radical animal-rights lobby would surely be upset.

Peter and Cathy had been planning to go to Barberian's, their favorite steakhouse, for dinner that night. At the last minute, though, Peter canceled their reservation and they went to a vegetarian restaurant instead.

When Peter Hobson had taken a university elective in taxonomy, the two species of chimpanzees had been *Pan troglodytes* (common chimps) and *Pan paniscus* (pigmy chimps).

But the split between chimps and humans had occurred just 500,000 generations ago, and they still have 98.4 percent of their DNA in common. In 1993, a group including evolutionist Richard Dawkins and best selling science-fiction writer Douglas Adams published the *Declaration on Great Apes,* which urged the adoption of a bill of rights for our simian cousins.

It took thirteen years, but eventually their declaration came to be argued at the UN. An unprecedented resolution was adopted formally reclassifying chimpanzees as members of genus *Homo,* meaning there were now three extant species of human-

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ity: *Homo sapiens, Homo troglodytes,* and *Homo paniscus.* Human rights were divided into two broad categories: those, such as the entitlement to life, liberty, and freedom from torture, that applied to all members of genus *Homo;* and other rights, such as pursuit of happiness, religious freedom, and ownership of land, that were reserved exclusively to *H. sapiens.*

Of course, under *Homo* rights, no one could ever kill a chimp again for experimental purposes—indeed, no one could imprison a chimp in a lab. And many nations had modified their legal definitions of homicide to include the killing of chimps.

Adrian Kortlandt, the first animal behaviorist to observe wild chimpanzees, once referred to them as "eerie souls in animals' furs." But now Peter Hobson was in a position to see how literally Kortlandt's observation should be taken. The soulwave existed in *Homo sapiens.* It did not exist in *Bos taurus,* the common cow. Peter supported the simian-rights movement, but all the good that had been done in the last few years might be undone if it were shown that humans had souls but chimps did not. Still, Peter knew that if he himself did not do the test, someone else eventually would.

Even though chimps were no longer captured for labs, zoos, or circuses, some were still living in human-operated facilities. The United Kingdom, Canada, the U.S., Tanzania, and Burundi jointly funded a chimpanzee retirement home in Glasgow—of all places—for chimps that couldn't be returned to the wild. Peter phoned the sanctuary, to find out if any of the chimps there were near death. According to the director, Brenda MacTavish, several were in their fifties, which was old age for a chimp, but none were terminal. Still, Peter arranged to have some scanning equipment shipped to her.

"And so," Peter said to Sarkar during their weekly dinner at Sonny Gotlieb's, "I think I'm ready to go public now. Oh, and my marketing people have come up with a name for the superEEG: they're calling it a SoulDetector."

"Oh, please!" said Sarkar.

Peter grinned. "Hey, I always leave those decisions up to Joginder and his people. Anyway, the SoulDetector patents are in place, we've got a backlog of almost two hundred units ready for shipment, I've got three good recordings of the soulwave leaving human beings, I know that at least some animals don't have souls, and I'll hopefully soon have the data on chimps, as well."

Sarkar spread lox on a bagel half. "You're still missing one important piece of information."

"Oh?"

"I'm surprised you haven't thought of the question yourself, Peter."

"What question?"

"The flip side of your original inquiry: you know now when the soul leaves the body. But when does the soul arrive?"

Peter's jaw went slack. "You mean—you mean in a fetus?"

"Precisely."

"Holy shit," said Peter. "I—I could

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get in a lot of trouble asking that question."

"Perhaps," said Sarkar. "But as soon as you go public, someone will ask it."

"The controversy will be incredible."

Sarkar nodded. "Indeed. But I'm surprised it hadn't occurred to you."

Peter looked away. He'd been suppressing it, no doubt. An old wound, long since healed. Or so he'd thought.

Damn, thought Peter. God damn.

Chapter 13

It had happened twelve years ago, during their first year of marriage. Peter remembered it all vividly.

October 31, 1999. Even back then, they didn't eat at home often. But they'd always thought it rude to go out on Halloween—someone should be in to give treats to the kids.

Cathy made fettuccine Alfredo while Peter put together a Caesar salad with real bacon bits crisped in the microwave, and they collaborated on making a cake for dessert. They had fun cooking together, and the tight confines of the tiny kitchen they'd had back then made for plenty of enjoyable contact as they squeezed past each other, jockeying for access to the kitchen's various cupboards and appliances. Cathy had ended up with flour stains in the shapes of Peter's handprints on each of her breasts, while Peter had her handprints on his bum.

But after they'd finished eating the salads and had made a good start on the pasta, Cathy had said, without preamble, "I'm pregnant."

Peter had put his fork down and looked at her. "Really?"

"Yes."

"That's—" He knew he should say "that's wonderful," but he was unable to get the second word out. Instead he settled for "Interesting."

She chilled visibly. "Interesting?"

"Well, I mean, it's unexpected, that's all." A pause. "Weren't you—" Another pause. "Damn."

"I think it was that weekend at my parents' cottage," she said. "Remember? You'd forgotten to—"

"I remember," said Peter, a slight edge in his voice.

"You said you'd have a vasectomy when you turned thirty," Cathy said, a tad defensively. "You said if by then we still didn't want to have kids, you'd do it."

"Well, I wasn't bloody well going to do it on my birthday. I'm *still* thirty. And, besides, we were still discussing whether to have a child."

"Then why are you angry?" asked Cathy.

"I—I'm not." He smiled. "Really, darling, I'm not. It's just a surprise, that's all." He paused. "So if it was that weekend, you're what? Six weeks along?"

She nodded. "I missed my period, so I bought one of those kits."

"I see," said Peter.

"You don't want the baby," she said.

"I didn't say that. I don't know what I want."

At that point, the doorbell rang. Peter got up to answer it.

Trick or treat, he thought. Trick or treat.

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* * *

Peter and Cathy had waited another three weeks, weighing their options, their lifestyle, their dreams. Finally, though, they made their decision.

The abortion clinic on College Street had been in an old two-story brownstone. On its left had been a greasy spoon called Joes—no apostrophe—that advertised a breakfast special with two "egg's" any way you like them. On its right had been an appliance store with a hand-lettered sign in the window that said, "We do repairs."

And in front of the clinic there had been protesters, marching up and down the sidewalk, carrying placards.

Abortion is murder, said one.

Sinner, repent, said another.

Baby's have rights too, said a third, perhaps produced by Joe's sign-maker. A bored-looking police officer was leaning against the brownstone's wall, making sure the protesters didn't get out of hand.

Peter and Cathy parked across the street and got out of their car. Cathy looked toward the clinic and shivered, even though it wasn't particularly cold. "I didn't think there would be that many protesters," she said.

Peter counted eight of them—three men and five women. "There're always going to be some."

She nodded.

Peter moved next to her and took her hand. She squeezed it, and managed a slight, brave smile. They waited for a break in the traffic, then crossed.

As soon as they arrived at the other side, the protesters closed in on them. "Don't go in there, lady!" shouted one. "It's your *baby!*" shouted another. "Take some time," shouted a third. "Think it over!"

The cop moved close enough to see that the protesters weren't actually touching Cathy or preventing her from gaining access.

Cathy kept her eyes facing straight ahead.

Eggs any way you like, thought Peter. Repairs done here.

"Don't do it, lady!" shouted one of the protesters again.

"It's your *baby!*"

"Take some time! Think it over!"

There were four stone steps leading up to the wooden doors of the clinic. She started up them, Peter right behind.

"It's . . . !"

"Don't . . . !"

"Take . . . !"

Peter stepped ahead to open the door for Cathy.

They went inside.

Peter had had his vasectomy the following week. He and Cathy never spoke again of that episode from their past, but sometimes when her sister's daughters were visiting, or when they ran into a neighbor taking a baby for a stroll, or when they saw children on TV, Peter would find himself feeling wistful and sad and confused, and he would steal a look at his wife and see in her large blue eyes the same mix of emotions and uncertainty.

And now, they had to face that moral issue all over again.

There was no way to put a scanning

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skull cap on a fetus, of course. But Peter didn't need to scan all electrical activity in the unborn child's brain—all he needed was equipment to detect the high-frequency soulwave. It took him days of work, but he eventually managed to cobble together a scanner that could be laid on a pregnant woman's belly to detect the soulwave inside. The unit incorporated some of the scanning-at-a-distance technology from the Hobson Monitor, and employed a directional sensor to make sure the mother's own soulwave wasn't mistakenly picked up.

The soulwave was exceedingly faint, and the fetus was deep within the woman's body. So, just like a telescope taking prolonged exposures to build up an image, Peter suspected this sensor would probably have to be in place for about four hours before a determination could be made of whether the soulwave was present.

Peter went down to his company's finance department. One of the senior analysts there, Victoria Kalipedes, was just beginning her ninth month of pregnancy.

"Victoria," Peter said, "I need your help."

She looked up expectantly. Peter smiled at the thought. Everything she did these days was expectantly. "I've got a new prototype sensor I'd like you to help me test," he said.

Victoria looked surprised. "Does it have to do with my baby?"

"That's right. It's just a sensor web that's laid over your belly. It won't hurt you, and it can't harm the baby in any way. It's, well, it's like an EEG—it detects activity in the fetal brain."

"And there's no way it can hurt the baby?"

Peter shook his head. "None."

"I don't know. . . ."

"Please." Peter surprised himself with the forcefulness with which he said the word.

Victoria considered. "All right. When do you need me?"

"Right now."

"I've got lots of work to do today—and you know what my boss is like."

"Placing the sensor will only take a few minutes. Because the signals are so faint, you'll have to wear it for the rest of the afternoon, but you'll be able to go on with your work."

Victoria got to her feet—no easy task this late in her pregnancy—and went with Peter to a private room. "I'm going to describe to you how the sensor should be placed," said Peter, "then I'll leave you alone and let you put it on yourself. It should fit under your clothes without difficulty."

Victoria listened to Peter's instructions, then nodded.

"Thank you," said Peter, as he left her to undress. "Thank you very much."

At the end of the day, he had the results. The sensor had no trouble detecting the soulwave coming from Victoria's fetus. Not too surprising: had the baby been removed at this late point in the pregnancy, it would probably have survived on its own. But how soon into a pregnancy did the soulwave first appear?

Peter flipped through his compu-

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terized Rolodex until he found the number he wanted: Dinah Kawasaki, a woman he had taken some courses with at U of T who now had an obstetrics practice in Don Mills.

He listened nervously to the electronic tones as the computer dialed the number. If Dinah could convince some of her patients to help him, he'd soon have his answer.

And, Peter realized, he was afraid of what that answer might be.

Chapter 14

October 2011

Thirty-two of Dinah Kawasaki's expectant patients did agree to participate in testing Peter's scanning equipment. That wasn't surprising: Peter had offered a fee of $500 per patient simply for wearing the scanner for four hours. Each patient was one week farther along in her pregnancy than the one before.

Peter would eventually want to do studies throughout their individual terms on multiple women, but the initial results were clear. The soulwave arrived sometime between the ninth and the tenth week of pregnancy. Before that, it simply did not exist. He'd need much finer studies to show whether it arose from within the fetal brain, or—less likely, Peter thought—somehow arrived from the outside.

Peter knew that this would change the world, almost as much as the realization that some form of life after death actually existed. Some would still quibble with the interpretation, but Peter could now say categorically whether or not a given fetus was a person—whether or not its removal would be simply sucking out an unwanted growth or an act of murder.

The implications would be profound. Why, if the pope could be convinced that the soulwave really was the physical signature of the immortal being, and that the soul only appeared ten weeks into pregnancy, perhaps he'd remove his restriction on birth control and on early abortion. Peter remembered that back in 1993, the then-pope had originally told women who had been raped by soldiers in Bosnia-Herzegovina that they would be damned unless they brought their babies to term. And the current pope still refused to allow birth control in famine-torn areas, even when babies would starve to death once born.

Of course, the women's movement, of which Peter considered himself a supporter, would react too.

Peter had always had a hard time with abortion, especially in industrialized countries. Perfectly reliable, unobtrusive methods of birth control existed. Peter had always accepted intellectually that a woman had the right to an abortion on demand, but he'd found the whole issue distasteful. Surely unwanted conception was something best avoided in the first place? Surely birth control—by both partners in a relationship—wasn't too much to ask? Why cheapen the wonder of reproduction?

It had taken all of ten minutes on the net to dig up the statistic that one in five pregnancies in North America ended in abortion. And yet, of course, he and Cathy had conceived all those

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years ago without planning to. Him a Ph.D., her with a degree in chemistry—two people who should have known better.

Nothing is ever as simple in the concrete as it is in the abstract.

But now, perhaps, there was justification for after-conception birth control. The soul, whatever the soul might be, arrived only after sixty or more days of gestation.

Peter was no futurist, but he could see where society would go: within a decade, laws would doubtless change to allowing abortion on demand up until the arrival of the soulwave. Once the soulwave was present in the fetus, the court would rule that the unborn child was in fact a human being.

Peter had wanted answers—cold, hard facts. And now he had them.

He took a deep breath. He was a rationalist. He knew that there had always been only three possible answers to the moral question raised by abortion. One: a child is a human being from the moment of conception. That had always seemed silly to Peter; at conception a child is nothing but a single cell.

Two: a child becomes a human being the moment it exits from the mother's body. That had seemed equally silly. Although a fetus draws nutrition from the mother until the umbilical cord is severed, the fetus is developed enough to support itself, if need be, weeks before the normal end of a pregnancy. Clearly the cutting of the cord is as arbitrary as the cutting of the ribbon to open a new mall. The fetus is a human being with an independent heart and brain—and thoughts—prior to emerging into the world.

So all Peter had done was prove what should have been expected. Option three: somewhere between the two extremes—between conception and birth—a fetus becomes a human being in its own right—and with its own rights.

That option three turned out to be correct should have been intuitively obvious. Even many religions held that the arrival of the soul occurred sometime in the middle of the pregnancy. Saint Thomas Aquinas had allowed abortion to the sixth week for male fetuses and the third month for females, those being the points at which he believed the soul entered the body. And in Muslim belief, according to Sarkar, the *nafs* enters the fetus on the fortieth day after conception.

Granted, none of those coincided with Peter's figure of nine or ten weeks. But the certain knowledge that there was a specific point at which the soul did arrive would—the thought occurred to him again—would change the world. And, of course, not everyone would think it a change for the better.

Peter wondered what it would be like to see himself burned in effigy on TV.

It had been just over nine weeks since Cathy had told Peter about her affair. Things had remained strained between them throughout that period. But now it was necessary that they have a serious talk—a talk about

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a different crisis, a crisis from their past.

Today was Monday, October 10—Canadian Thanksgiving. Both of them had the day off. Peter came into the living room. Cathy was sitting on the love seat, doing *The New York Times* crossword. Peter came over and sat next to her.

"Cathy," he said, "there's something I have to say."

Cathy's enormous eyes met his, and suddenly Peter realized what she was thinking. He'd made his decision, she thought. He was leaving her. He saw in her face all the fear, all the sadness, all the courage. She was struggling for composure.

"It's about our baby," said Peter.

Cathy's face changed abruptly. She was confused now. "What baby?"

Peter swallowed hard. "The baby we, ah, aborted twelve years ago."

Cathy's eyes were moving back and forth. She clearly didn't understand.

"Next week, my company will be making a public announcement about the soulwave," he said. "At that time, some additional research will be revealed. But . . . but I wanted you to hear about it first."

Cathy was silent.

"I know now when the soulwave arrives in a child."

She read his manner, read his hesitancy. She knew his every gesture, his whole body-language vocabulary. "Oh, God," Cathy said, her eyes wide in horror. "It arrives early, doesn't it? Prior to when we—when we—"

Peter said nothing.

"Oh, God," she said again, shaking her head. "It was the Nineties," she said, as if that summed it all up.

The Nineties. Back then, the abortion issue, like most others, had been simplified to a ridiculous sloganeering level: "Pro-choice"—as if there were another faction that was anti-choice; "Pro-life"—as if there had been a group that was against life. No grays were allowed. In the circle the Hobsons had moved in—educated, well-off, liberal Eastern Canada—pro-choice had been the only stance to take.

The Nineties.

The politically correct Nineties.

Peter shook his head. "It's not clear," he said. "We did it right around the time the soulwave would have first appeared." He paused, not knowing what to say. "It might have been OK."

"Or it might have been . . . might have been. . . ."

Peter nodded. "I'm so sorry, Cathy."

She chewed her lower lip, confused and sad. Peter reached out and touched her hand.

Chapter 15

Hobson Monitoring had a standard database of medical journalists worldwide to whom electronic press kits were routinely sent. A few members of Peter's senior staff argued that this particular release should also go to religion editors, but Peter vetoed that. He was still uncomfortable with the moral aspects of the discovery. Besides, everyone from *The National Enquirer* on down would be clamoring for interviews soon enough. An invitation to the press conference

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went out by mail and courier three days in advance of the actual event. Peter was uneasy about the wording of the invitation, but Joginder Singh, his PR person, was adamant that this was the correct approach:

Hobson Monitoring Ltd. invites you to attend a press conference on Thursday, October 20, at 10:00 A.M. *in room 104 of the Metro Toronto Convention Center. We will be unveiling a fundamental breakthrough in science. Sorry, folks—no hints until you get here. But we promise that this story will be front-page news around the globe. Video linkups are available for those unable to attend in person; contact Joginder at Hobson Monitoring for details.*

Several reporters did call, trying to sniff out whether the story would really be worth pursuing, or if this was just going to be the release of a new piece of hospital gadgetry. But no advance information was given out. Everyone had to wait until Thursday morning. And then. . . .

About forty reporters showed up for the press conference—Hobson Monitoring had only once before gotten more, back when it had announced its first public share offering. Peter knew half the reporters by name: Buck Piekarz, medical correspondent for *The Toronto Star;* Cory Tick, his counterpart from *The Globe and Mail;* Lianne Delany from "CBC Newsworld"; a fat guy who covered Canadian stories for *The Buffalo News;* a stringer for *USA Today;* many more. The reporters helped themselves to fresh fruit and coffee while they chatted amongst themselves. They were surprised they didn't receive press kits up front, although Peter and Joginder assured them that full kits, including data disks and transcripts of Peter's remarks, would be distributed as they exited. Several of the journalists present would videotape the conference, anyway.

Cathy had taken a vacation day to be there with Peter. At a quarter after ten, he made his way up to the front of the room. Cathy beamed at him, and, despite the butterflies in his stomach, he drew strength from her presence. "Hello, everyone," he said, smiling at them all in turn, but holding a special, lingering smile on Cathy. "Thank you for coming out. Please forgive all the secrecy, I know it seems a tad melodramatic. But what we're going to announce here today is something very special, and we wanted to be sure that responsible journalists heard about it first." He smiled. "Joginder, if you'll dim the lights please? Thanks. Now, everyone, please watch the wall monitor. You'll all be getting copies of the recording I'm about to play when you leave. All set? Run the demo, please, Joginder."

The journalists watched intently as Peter narrated a slowed-down playback of the brain scans of Peggy Fennell's death. Peter went into a fair bit of technical detail—these were, after all, medical correspondents. When the soulwave actually departed from Mrs. Fennell's head a murmur moved through the audience.

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"Play that last bit back again," called out Piekarz from *The Star*. Peter signaled Joginder to do so.

"Exactly what is that?" asked another reporter.

Peter looked at Cathy, sitting in the front row. Her eyes were twinkling. He affected a shrug. "It's a cohesive electrical field that leaves the body through the temple at the moment of death."

"At the exact moment of death?" asked Delaney, the woman from *Newsworld*.

"Yes. It's the final bit of electrical activity in the brain."

"So—so it's what?" said the woman. "Some kind of a soul?" She said the word offhandedly, as if a joke, giving her room to retreat in case she was making a fool of herself.

But in the weeks since Sarkar had first uttered that term, Peter had grown more comfortable with it. "Yes," he said. "That's exactly what we think it is." He raised his voice, speaking generally to the room. "There it is, ladies and gentlemen: the first ever direct scientific recording of what may be a human soul leaving a body."

A buzz erupted, everyone talking at once. Peter spent the next two hours answering questions, although some of the print reporters with early deadlines grabbed the press kits and exited almost at once. He made clear that his studies had yet to reveal exactly what happened to the soulwave after departure—it seemed to remain coherent, but there was still no proof that it didn't dissipate shortly after leaving the body. He also stressed that very little data was available yet about the content or structure of the soulwave, and, in particular, about what, if any, meaningful information it contained.

But it made no difference. The idea of a soul was an archetype, universally grasped. People already were sure, in their hearts, of what the soulwave represented.

That night, Cathy and Peter saw that the CBC TV story was picked up by CNN in the States and the BBC World Service. The announcement was all over the net within hours and made front-page news in the evening editions of *The Toronto Star* and several American papers, and was plastered across page one of newspapers around the world the next day. Within twenty-four hours, the entire developed world knew about the discovery.

Suddenly Peter Hobson was a celebrity.

"Is the caller still there?" asked Donahue, back on daytime TV after his failed presidential bid.

"I'm here, Phil."

Donahue made his tortured face; precious seconds were being wasted. "Go ahead—I have very little time."

"What I'd like to know," said the caller's voice, "is what life after death is really like. I mean, we know now that it exists, but what's it *really* like?"

Donahue turned to Peter. "That's a very good question, caller. Dr. Hobson, what is the afterlife like?"

Peter shifted in his chair. "Well, that's more a subject for philosophers, I'm afraid, and—"

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Donahue turned toward the studio audience. "Audience, are we prepared for these questions? Do we really want to know the answers? And what will America do if the afterlife turns out to be unpleasant?" He spoke into the air. "Show 'em, Bryan —number fourteen."

A chart appeared on the screen. "Sixty-seven percent of the people of this good country," said Donahue, "believe that the soulwave proves the Judeo-Christian model of a heaven and a hell. Only eleven percent believes that your discovery, Dr. Hobson, disproves that model."

The chart disappeared. Donahue spied a raised hand in the back of the studio. Still spry at seventy-five, he bolted for the back row and shoved a microphone under a woman's chin.

"Yes, ma'am. You had a brief comment."

"That's right, Phil. I'm from Memphis—we love your show down there."

First the little-boy face, patted on the head. "Thank you, ma'am." Then the pained face, as if something was caught going down his gullet. "I have very little time."

"My question is for the doctor. Do you think your discovery is going to get you into heaven, or are you going to hell for interfering in God's mysteries?"

Close up on Peter. "I—I have no idea."

Donahue did his standard theatrical arm gesture that ended with his finger pointing directly into the camera. "And we'll be right back. . . ."

* * *

The silver-haired Latin fox turned to face the audience. According to the tabloids, he'd recently undergone the Life Unlimited process, so viewers had centuries of his particular brand of television to look forward to.

"Life after life," he said, portentously. "That's our focus on this edition of 'Geraldo.' Our guests today include Peter Hobson, the Ottawa scientist who claims to have captured the immortal soul on film, and Monsignor Carlos Latina of the Archdiocese of Los Angeles." Geraldo turned to the man wearing a black cassock. "Monsignor—where do you think the souls are today of those clergy members who molested boys in church-run orphanages?"

(Roll computer graphic of Capitol Building dome. Cue music.) Announcer: "From ABC News: 'This Week with Peter Jennings.' Now from our Washington headquarters, here's Peter Jennings."

Jennings, gray-haired, dour, facing into the camera: "The soulwave—fact or fantasy? Religious revelation or scientific truth? We'll ask our guests: Peter Hobson, the engineer who first detected the soulwave; Carl Sagan, author of the best-selling *Eyes of Creation;* and Helen Johannes, Presidential Advisor on Religion in America. Some background on all this from our man Kyle Adair. And joining me in our Washington studio will be—

(Medium shot of Donaldson, his features sharp despite his wrinkles; his shoe-polish brown toupee looking obviously fake.)

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"Sam Donaldson—"

(Medium shot of silver-haired Will, wall-eyed and bow-tied, looking like a retired plantation owner.)

"—and George Will. Later, we'll be joined by commentator Sally Fernandez of *The Washington Post*... All here on our Sunday program."

(Run commercials: Archer Daniel Midland's new all-vegetable automobile. General Dynamics—"our work may be classified, but we're a good corporate citizen." Merrill Lynch—"Because someday the economy *will* turn around.")

(Roll pre-recorded backgrounder.)

(Fade up in studio.)

Jennings: "Kyle, thank you."

(Recap guests and panelists.)

(Insert Peter Hobson on wall monitor, with dateline display at top showing "Toronto.")

Sam Donaldson, leaning forward: "Professor Hobson, your discovery of the soulwave could be seen as a great liberator of oppressed people, final proof that all men and women are created equal. What effect do you think your discovery will have on totalitarian regimes?"

Hobson, politely: "Excuse me, but I'm not a professor."

Donaldson: "I stand corrected. But don't duck my question, sir! What effect will your discoveries have on the human-rights violations going on in the eastern Ukraine?"

Hobson, after a moment's reflection: "Well, I'd love to think that I've struck a blow for human equality, of course. But it seems that our ability to be *inhuman* has survived every challenge to it in the past."

George Will, over steepled fingers: "Dr. Hobson, the average American, struggling under the burden of an excessive government with a ravenous appetite for tax dollars, cares not one whit about the geopolitical ramifications of your research. The average church-going American wants to know, in precise and plain language, sir, exactly what characteristics the afterlife actually has."

Hobson, blinking: "Is that a question?"

Will: "It is *the* question, Dr. Hobson."

Hobson, shaking head slowly: "I have no idea."

Chapter 16

Peter was not about to let his newfound celebrity interfere with his Tuesday evening dinners with Sarkar at Sonny Gotlieb's. But he did have something very specific that he wanted to explore with Sarkar, and he began without preamble. "How do you create an artificial intelligence? You work in that field—how do you do it?"

Sarkar looked surprised. "Well, there are many ways. The oldest is the interview method. If we wanted a system to do financial planning, we would ask questions of several financial planners. Then we reduce the answers as a series of rules that can be expressed in computer code: 'if A and B are true, do C.' "

"But what about that scanner my company built for you? Aren't you doing full brain dumps of specific people now?"

"We're making good progress to-

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ward that. We've got a prototype called RICKGREEN, but we're not ready to go public with it. You know that comedian, Rick Green?"

"Sure."

"We did a full scan on him. The resulting system can now tell jokes that are just as funny as the ones the real Rick tells. And by giving it access to the Canadian Press and UPI news feeds, it can even generate new topical humor."

"OK, so you can essentially clone in silicon a specific human mind—"

"Get with the twenty-first century, Peter. We use gallium arsenide, not silicon."

"Whatever."

"But you have hit upon what makes the problem crisp: we are just at the point where we can clone *one* specific human mind—a shame that such a technique did not exist in time to scan Stephen Hawking. But there are very few applications in which you want the knowledge of just one person. For most expert systems, you really want the *combined* knowledge of many practitioners. So far, there is no way to combine, say, Rick Green and Jeremy Seinfeld, or to build a combined Stephen Hawking/Mordecai Almi neural net. Although I had high hopes for this technology, I suspect most of the contracts we'll get will be for duplicating the brains of autocratic company presidents who think their heirs are going to be interested in what they have to say after they're dead."

Peter nodded.

"Besides," said Sarkar, "total brain dumps are turning out to be a tremendous waste of resources. When we created RICKGREEN, all we were really interested in was his sense of humor. But the system also gives us everything else Rick knows, including his approaches to raising his children, an endless amount of expertise about model trains, which are his hobby, and even his cooking technique, something no one in his right mind would want to emulate."

"Can't you pare it down to isolate just the sense of humor?"

"That's difficult. We're getting good at decoding what each neural net does, but there are many interconnections. When we tried deleting the part about child-rearing, we found the system no longer made jokes about family life."

"But you *can* make an accurate duplicate of a specific human mind on a computer?"

"It's a brand-new technique, Peter. But, so far, yes, the duplication seems accurate."

"And you can, at least to some extent, decode the functions of the various neural interconnections?"

"Yes," said Sarkar. "Again, we've only tried it on the RICKGREEN prototype—and that was a limited model."

"And once you've identified a function you can delete it from the overall brain simulacrum?"

"Bearing in mind that deleting one thing may change the way something that seems unrelated will respond, yes, I'd say we're at the point at which we can do that."

"All right," said Peter. "Let me propose an experiment. Say we make

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two copies of a specific person's mind. In one of them you excise everything related to the physical body: hormonal responses, sexual urges, things like that. And in the second one, you remove everything related to bodily degeneration, to fear of old age and dying, and so on."

Sarkar ate a matzo ball. "And what would the point be?"

"The first one would be to answer that question everyone keeps asking me: what is life after death really like? What parts of the human psyche could persist separate from the body? And, while we're at it, I figure we'd do the second one—a simulation of a being who knew he was physically immortal, like someone who has undergone that Life Unlimited process."

Sarkar stopped chewing. His mouth hung open, giving an undignified view of a masticated dumpling. "That's—that's incredible," he said at last, around his food. "*Subhanallah*, what an idea."

"Could you do it?"

Sarkar swallowed. "Maybe," he said. "Electronic eschatology. What a concept."

"You'd need to make the two brain dumps."

"We'd do the dump once, of course. Then we'd just copy it twice."

"Copy it once, you mean."

"No, twice," said Sarkar. "You can't do an experiment without a control; you know that."

"Right," said Peter, slightly embarrassed. "Anyway, we'd make one copy which we would modify to simulate life after death. Call it—call it the Spirit simulacrum. And another to simulate immortality."

"And the third we would leave unmodified," said Sarkar. "A baseline or control version that we can compare to the original living person to make sure that the simulacra retain their accuracy as time goes on."

"Perfect," said Peter.

"But you know, Peter, this wouldn't necessarily simulate true life-after-death. It's life outside the physical body—but who knows if the soulwave carries with it any of our memories? Of course, if it doesn't, then it's not really a meaningful continuation of existence. Without our memories, our pasts, what we were, it wouldn't be anything we'd recognize as a continuation of the same person."

"I know," said Peter. "But if the soul is anything like what people believe it to be like—just the mind, without the body—then this simulation, at least, would give us some idea of what that kind of soul would be like. Then I could have something intelligent to say the next time I get asked that 'what's life after death really like?' question."

Sarkar nodded. "But why the research into immortality?"

"I went to one of those Life Unlimited seminars a while ago."

"Really? Peter, surely you don't want that."

"I—I don't know. It's fascinating, in a way."

"It's stupid."

"Maybe, but it seems we could kill two birds with one stone with this research."

"Perhaps," said Sarkar. "But who

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would we simulate?"

"How about you?" asked Peter.

Sarkar raised a hand. "No, not me. The last thing I want to do is live forever. True joy is possible only after death; I look forward to the felicity to be given to my realized soul in the next world. No, they were your questions, Peter. Why not use you?"

Peter stroked his chin. "All right. If you're willing to undertake the project, I'm willing both to fund it and to be the guinea pig." He paused. "This could answer some really big questions, Sarkar. After all, we know now that both physical immortality is possible and that some form of life after death exists. It would be a shame to choose one if the other turned out to be better."

"Hobson's choice," said Sarkar.

"Eh?"

"Surely you know the phrase. Your last name is Hobson, after all."

"I've heard the expression once or twice."

"It refers to Thomas Hobson, a liveryman in England in, oh, the seventeenth century, I think. He rented out horses, but required his customers to take either the horse nearest the stable door or none at all. A 'Hobson's choice' is a choice that offers no real alternative."

"So?"

"So you don't get an alternative. Do you seriously think that if you were to bankrupt yourself buying nanotechnology immortality that Allah couldn't take you anyway if He wanted to? You have a destiny, as do I. We have no choice. When it's time for you to go to the stable, the horse nearest the door *will* be the one that is meant for you. Call it Hobson's choice or *qadar Allah* or *kismet* —whatever term you use, it's the foredestiny of God."

Peter shook his head. He and Sarkar rarely talked about religion, and he was beginning to remember why. "Are you willing to undertake the project?"

"Sure. My part is easy. You're the one who is going to have to face himself. You will see your own personality, the inner workings of your own mind, the interconnections that drive your thoughts. Do you really choose to do that?"

Peter reflected for a moment. "Yes," he said. "I really do choose that."

Sarkar smiled. "Hobson's choice," he said, and signaled the server to bring the check.

NET NEWS DIGEST

The Archdiocese of Houston, Texas, would like to remind everyone that this coming Wednesday, November 2, is All Souls' Day—the day on which prayers are offered for souls in purgatory. Because of the recent surge of interest in this topic, a special mass will be held at the Astrodome Wednesday evening at 8:00 P.M.

The front-page editorial in the November issue of "Our Bodies," *newsletter of the group Women in Control, headquartered in Manchester, England, denounces the discovery of so-called fetal soulwaves as "yet another attempt by men to impose control over women's bodies."*

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* * *

Raymond Moody's Life After Life, *first published in 1975, was reissued this week by NetBooks and immediately surged to number two on* The New York Times *best-seller list in the category of premium-download nonfiction.*

In spirited trading, Hobson Monitoring Limited (TSE: HML) closed today at 57-⅛, up 6-⅜ from the day before, on a volume of 35,100 shares. This represents a new 52-week high for the Toronto-based biomedical equipment maker.

A demonstration was held today out front of the free-standing Morgentaler Abortion Clinic in Toronto, Ontario, by the organization Defenders of the Unborn. "Abortion prior to the arrival of the soulwave is still a sin in the eyes of God," said protester Anthoula Sotirios. "For the first nine weeks of pregnancy, the fetus is a temple, being prepared for the arrival of the divine spark."

Chapter 17

Thursday evening at home. Peter had long ago programmed the household computer to scan the TV listings for topics or shows that would interest him. For two years, he'd had a standing order for the VCR to record the film *The Night Stalker*—a made-for-TV movie he'd first encountered as a teenager—but so far it hadn't come on. He also asked to be alerted whenever an Orson Welles film was on, whenever Ralph Nader or Stephen Jay Gould was going to be on any talk show, and for any episodes of "Night Court" in which Brent Spiner guest-starred.

Tonight, DBS Cairo was showing Welles in "The Stranger" in English with Arabic subtitles. Peter's VCR had a subtitle eraser—it scanned the parts of the image adjacent to the subtitles, as well as the frames before and after the subtitles appeared, and filled in an extrapolation of the picture that had been obscured by the text. Quite a find: Peter hadn't seen "The Stranger" for twenty years. His VCR hummed quietly, recording it.

Maybe he'd watch it tomorrow. Or Saturday.

Maybe.

Cathy, sitting across the room from him, cleared her throat, then said, "My coworkers have been asking about you. About us."

Peter felt his shoulders tense. "Oh?"

"You know: about why we haven't been at the Friday-night gatherings."

"What have you told them?"

"Nothing. I've made excuses."

"Do they . . . do you think they know about . . . about what happened?"

She considered. "I don't know. I'd like to think they don't, but . . ."

"But that asshole Hans has a mouth on him."

She said nothing.

"Have you heard anything? Snide comments? Innuendoes? Anything to make you think your coworkers know?"

"No," said Cathy. "Nothing."

"Are you sure?"

She sighed. "Believe me, I've been

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particularly sensitive to what they've been saying. If they are gossiping behind my back, I haven't picked up on it. No one has said a word to me. Really, I suspect they don't know."

Peter shook his head. "I—I don't think I could take it if they knew. Facing them, I mean. It's . . ." he paused, trying to come up with the appropriate word, ". . . humiliating."

She knew better than to reply.

"Damn," said Peter. "I hate this. I really fucking hate this."

Cathy nodded.

"Still," said Peter, "I suppose . . . I suppose if we're ever going to have a normal life again, we've got to start going out, seeing people."

"Danita thinks that would be wise, too."

"Danita?"

"My counselor."

"Oh."

She was quiet for a moment, then: "Hans left town today. He's attending a conference. If we went out after work with my friends tomorrow, he wouldn't be there."

Peter took a deep breath, exhaled it noisily. "You're sure he won't be there?" he said.

She nodded.

Peter was silent for a time, marshaling his thoughts. "All right," he said at last. "I'll give it a try, as long as we don't stay too long." He looked her in the eyes. "But you better be right about him not being there." His voice took on a tone Cathy had never heard before, a stone-cold bitterness. "If I see him again, I'll kill him."

Peter arrived at The Bent Bishop early so that he could be sure of the seat directly beside his wife. The crew from Doowap Advertising had found a long table in the middle of the room this time, so they were all in captain's chairs. Peter did indeed get to sit next to Cathy. Opposite him was the pseudointellectual. His book-reader was loaded with Camus.

"'Evening, Doc," said Pseudo. "You're certainly in the news a lot these days."

Peter nodded. "Hello."

"Not used to seeing you here so early," Pseudo said.

Peter immediately realized his mistake. Everything should have been exactly as before. He should be doing nothing that would attract attention to him or Cathy.

"Ducking reporters," Peter said.

Pseudo nodded, and lifted a glass of dark ale to his lips. "You'll be glad to know Hans won't be here."

Peter felt his cheeks flush, but in the dim lighting of the pub it was probably invisible. "What do you mean?" Peter had intended the question to come out neutrally, but there'd been an undeniable edge to it. Next to him, Cathy patted his knee under the table.

Pseudo lifted his eyebrows. "Nothing, Doc. It's just that he and you don't seem to always get along. He was ribbing you a fair bit last time."

"Oh." The server had appeared. "Orange juice," said Peter.

The server turned to Cathy, her face a question. "Mineral water," Cathy said. "With lime."

"Nothing to drink today?" said Pseudo, as if the very concept was an

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affront to all things decent.

"I've, ah, got a headache," said Cathy. "Took some aspirin."

There was no end to lies, thought Peter. She couldn't say, I've stopped drinking because last time I got drunk I let a coworker fuck me. Peter felt his fists clenching beneath the table.

Two more of Cathy's friends arrived, a man and a woman, both middle-aged, both slightly heavy. Cathy said hi to them. "Light turnout tonight," said the man. "Where's Hans?"

"Hans is in Beantown," said Pseudo. Peter thought he'd been waiting all day to get to say "Beantown." "At that intereactive-video conference."

"Gee," said the woman. "It won't be the same without Hans."

Hans, thought Peter. *Hans. Hans.* Each uttering of his name was like a knife thrust. Haven't these people ever heard of pronouns?

The server reappeared and put some reconstituted orange juice in front of Cathy, and a small bottle of Perrier and a glass with a bruised lime wedge pushed into its rim in front of Peter. All non-alcoholic drinks were the same to her, he guessed. Peter and Cathy exchanged drinks, and the server took the newcomers' orders.

"So how are things with the two of you?" asked the newly arrived man, waving a hand generally at Peter and Cathy.

Cathy smiled. "Fine."

Why is he asking that? Peter just thought. *What does he know?*

"Fine," echoed Peter. "Just fine."

"You've been all over the TV, Peter," said Pseudo. "Going anywhere else soon?"

Well, I'm not going to fucking Beantown. "No," said Peter, then, "Maybe."

"We haven't made any plans," said Cathy smoothly. "But Peter has an understanding boss." A chuckle or two from those who knew that Peter *was* the boss at his company. "I've got to see how my schedule is shaping up at work. We've got that big Tourism Ontario contract coming up."

The woman nodded sympathetically. Evidently that particular job was the bane of her existence, too.

The server appeared with more drinks. Simultaneously, Toby Bailey, another of Cathy's coworkers, appeared.

"'Evening, all," said Toby. He indicated to the server that he'd have the same thing as Pseudo. "Where's Hans?"

"Boston," said Peter, preempting another uttering of "Beantown." Pseudo looked slightly disappointed.

"Did Donna-Lee go with him?"

"Not as far as I know," said Pseudo.

"Well, some American cutie is going to get porked tonight," said Toby, as if this was the most natural thing in the world. People chuckled. Hans seemed to have almost as big a presence when he wasn't there as when he was. Peter excused himself to go to the washroom.

"Well," observed Pseudo as Peter departed, "I guess even the rich and famous have to take a leak now and then."

Peter bristled as he made his way to the stairwell and walked down to the little basement that contained the

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two restrooms and a couple of pay phones. He didn't really have to go, but he needed a little peace and quiet, a little time to get his bearings. It was like they were all mocking him. It was like they all knew.

Of course they knew. Peter had heard enough of Hans's bragging in the past. Christ, they all probably knew about every one of Hans's conquests.

He leaned against a wall. A Molson's bimbo smiled at him from a poster. It had been a mistake coming here.

But wait—if Cathy's coworkers knew, they'd probably known for months. It was ages since she and Hans had first done it. Peter tried to think back to the last time he'd been here, and the time before that. Had there been any indication that they knew? Were they really behaving differently tonight?

He couldn't tell. Everything seemed different now. Everything.

He'd be humiliated if they knew. His private life invaded. On public view.

Humiliated. Degraded.

Christ, Hobson, can't keep a woman, eh?

God damn it.

Life had been so simple before.

This had been a mistake.

He headed back to the table.

He would endure it for another hour. He looked at his watch. Yes. Sixty minutes. He could take that.

Maybe.

Peter and Cathy walked wordlessly up to the door of their house. Peter touched his thumb to the FILE scanner, and he heard the locking mechanism disengaging. He stepped through the door into the tile-covered entry area and paused to remove his outdoor shoes. Four and a half pairs of Cathy's shoes were already lined up in front of the closet.

"Do you have to do that?" said Peter, pointing at them.

"I'm sorry," said Cathy.

"I'd like to be able to come into my own home without tripping over your shoes all the time."

"I'm sorry," she said again.

"You've got a shoe rack in the bedroom."

"I'll move them there," she said.

Peter placed his shoes on the mat. "You don't see me piling up shoes out here."

Cathy nodded.

Peter walked into the living room. "Computer—messages," he called out.

"None," said a synthesized voice.

He walked over to the couch, scooped up the remote, and sat down. He turned on the TV and began flipping channels, with the sound on *mute*.

"The pseudointellectual was in fine form tonight," said Peter sarcastically.

"Jonas," said Cathy. "His name is Jonas."

"What the fuck do I care what his name is?"

Cathy sighed, and went to make herself some tea.

Peter knew he was being mean. He didn't want to be this way. He'd been hoping tonight would go well, had been hoping that they could get on

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with their lives, with things the way they had always been.

But it wouldn't work.

Tonight had proved that.

He couldn't have anything to do with her coworkers ever again. Even without Hans there, the sight of these people reminded Peter of what she'd done—of what Hans had done.

Peter could hear the sounds of a spoon hitting china in the kitchen as Cathy stirred milk into her tea. "Aren't you going to join me?" he called out.

She appeared in the doorway that led to the kitchen, her face impassive.

Peter put down the remote and looked at her. She was trying to be cooperative, trying to be brave. He didn't want to be mean to her. He just wanted what they had had before.

"I'm sorry," Peter said.

Cathy nodded, hurt but brave. "I know."

Chapter 18

Sarkar Muhammed's artificial-intelligence company was called Mirror Image. Its offices were located in Concord, Ontario, north of Metro Toronto. Peter met Sarkar there on Saturday morning, and Sarkar took him upstairs to the newly created scanning room. It had originally been just a regular office. There were crushed indentations in the rug where filing cabinets had once been. There had also been a large window, but it had been completely covered with plywood panels to prevent light from coming in from outside, and the walls had been lined with gray foam rubber, molded in egg-carton shapes to deaden sound. In the center of the room was an old dentist's chair on a swivel base and along one wall was a bench covered with a PC, various oscilloscopes, and several other pieces of equipment, including some circuitry breadboards lying out in the open.

Sarkar motioned for Peter to sit in the dentist's chair.

"Just a little off the top," said Peter.

Sarkar smiled. "We are going to take *everything* off the top—get a complete record of everything in your brain." He positioned the scanner's skull cap on Peter's head.

"L'chayim," said Peter.

Sarkar loosely fastened the cap's chin strap and motioned for Peter to pull it tight. "Second down," said Peter. "Four yards to go."

Sarkar handed Peter two small earpieces. Peter inserted them. Finally, Sarkar handed him the test goggles: a pair of special glasses that projected separate video signals into each eye.

"Breathe through your nose," said Sarkar. "And try to keep swallowing to a minimum. Also, try not to cough."

Peter nodded.

"And don't do that," said Sarkar. "Don't nod. I'll assume you understand my instructions without you acknowledging them." He moved to his workbench and pressed some keys on the PC. "In many ways, this is going to be more complex than what you did in recording the soulwave's departure. There, you were simply looking for *any* electrical activity in the brain. But here, we must stimulate your brain in myriad ways, to ac-

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tivate every neutral net contained within—most nets are inactive most of the time, of course."

He pushed some more keys. "OK, we're recording now. Don't worry if you have to shift to get comfortable in the next few minutes; it'll take that long to calibrate, anyway." He spent what seemed a very long time making minute adjustments to his controls. "Now, as we discussed," said Sarkar, "you are going to receive a series of inputs. Some will be oral—spoken words or sounds on audio tape. Some will be visual: you will see images or words projected into your eyes. I know you speak French and a little Spanish; some of the inputs will be in those languages. Concentrate on the inputs, but don't worry if your mind wanders. If I show you a tree and that makes you think of wood, and wood makes you think of paper, and paper makes you think of paper airplanes, and airplanes make you think of lousy food, that's fine. Don't force the connections, though: this is not an exercise in free association. We just want to map which neural nets exist in your brain, and what excites them. Ready? No—you nodded again. OK, here we go."

At first, Peter thought he was seeing a standard barrage of test images, but it soon became apparent that Sarkar had supplemented that with images specifically related to Peter. There were pictures of Peter's parents, of the house he and Cathy lived in now and the one they'd lived in before it, shots of Sarkar's cottage, Peter's own high-school graduation photo, sound clips of Peter's voice, and Cathy's voice, and on and on; a *This Is Your Life* retrospect mingled with generic pictures of lakes and woods and football fields and simple mathematical equations and snatches of poetry and *Star Trek* trivia questions and popular music from when Peter had been a teenager and art and pornography and out-of-focus pictures that might have been Abe Lincoln or might have been a hound dog or might have been nothing at all.

Periodically, Peter got bored and his mind wandered to the night before—the disastrous night out with Cathy's coworkers. Damn, that had been a mistake.

Fucking Hans.

He couldn't even shake his head to fling off the thoughts. But by an effort of will, he tried to concentrate on the images. And yet, from time to time, they, too, would provoke the unpleasant memories: A picture of hands that made him think of Hans. Peter and Cathy's wedding photo. A pub. A parked car.

Nets fired.

They did four two-hour sets of this, with half-hour breaks for Peter to stretch and work his jaw and drink water and go to the bathroom. Sometimes the audio clips would reinforce the visuals images—he saw a picture of Mick Jagger and heard "Satisfaction." And sometimes they were jarringly opposite—the sight of a starving Ethiopian child coupled with the sounds of windchimes. And sometimes the images shown to his left eye were different than those shown to his right, and sometimes the sound

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played into one earpiece was completely unrelated to that pumped into the other.

Finally, it was over. Tens of thousands of images had been seen. Gigabytes of data had been recorded. And the sensors in the skull cap had mapped every nook and cranny, every thoroughfare and side street, every neuron and every net in Peter Hobson's brain.

Sarkar took the disk holding the brain scan down to his computer lab. He loaded it onto an AI workstation and copied everything into three different RAM partitions—producing three identical copies of Peter's brain, each isolated in its own memory bank.

"What now?" said Peter, sitting backwards on a stacking chair and leaning his chin on his arms folded over the chair's back.

"First, we label them." Sarkar, sitting on the barstool he preferred to a chair, spoke into the microphone on the console in front of him. "Login," he said.

"Login name?" said the computer's voice, female, emotionless.

"Sarkar."

"Hello, Sarkar. Command?"

"Rename Hobson 1 to Spirit."

"Please spell destination name."

Sarkar sighed. The word "Spirit" was doubtless in the computer's vocabulary, but Sarkar's accent occasionally gave it trouble. "S-P-I-R-I-T."

"Done. Command?"

"Rename Hobson 2 to Ambrotos."

"Done. Command?"

Peter piped up. "Why 'Ambrotos'?"

"It's the Greek word for immortal," said Sarkar. "You see it in words such as 'ambrosia'—the foodstuff that confers immortality."

"That darned private school education," said Peter.

Sarkar grinned. "Exactly." He turned back to the mike. "Rename Hobson 3 to Control."

"Done. Command?"

"Load Spirit."

"Loaded. Command?"

"OK," said Sarkar, turning to face Peter. "Spirit is supposed to simulate life after death. To do that, we begin by paring out all exclusively biological functions. That will not actually involve removing parts of the conscious brain, of course, but rather just disconnecting various networks. To find out which connections we can sever, we'll use the Dalhousie Stimulus Library. That's a Canadianized version of a collection of standard images and sound recordings originally created by the University of Melbourne; it's commonly used in psychological testing. As Spirit is exposed to each image or sound, we record which neurons fire in response."

Peter nodded.

"The stimuli are all cataloged by the type of emotion they're supposed to elicit—fear, revulsion, sexual arousal, hunger, *et cetera*. We look to see which neural nets are activated exclusively by biological concerns, and then zero those out. Of course, we have to go through the images several times in random sequences. That's because of action potentials: nets might not get activated if a sub-

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stantially similar combination of neurons was recently triggered by something else. Once we've finished doing that, we should have a version of your mind that approximates the way you would be if you were freed of all concerns about meeting physical needs—what you would be like if you were dead, in other words. After that, we'll do the same thing with Ambrotos, the immortal version, but for it we'll excise the fear of growing old and concerns about aging and death."

"What about the experimental control?"

"I'll feed it the same sorts of images and sound clips, just so that it will have been exposed to the same things as the other two versions, but I won't zero out any of its nets."

"Very good."

"OK," said Sarkar. He turned to face the console. "Run Dalhousie Version 4."

"Executing," said the computer.

"Estimate time to completion."

"Eleven hours, nineteen minutes."

"Advise when complete." Sarkar turned to Peter. "I'm sure you won't want to watch the whole thing, but you can see what is being fed to Spirit on that monitor."

Peter looked at the screen. A Monarch butterfly emerging from a cocoon. Banff, Alberta. A pretty woman blowing a kiss at the camera. Some 1980s movie star that Peter sort of recognized. Two men boxing. A house on fire. . . .

Chapter 19

November 2011

Sarkar had called Peter early Sunday morning to tell him the training and pruning of the simulacra was complete. Cathy was off looking at garage sales, a hobby whose appeal Peter had never understood, so Peter left a message for her with the household computer. He then hopped into his Mercedes and drove to Mirror Image's offices in Concord.

Once he and Sarkar were together in the computer lab, Sarkar said, "We'll try activating the Control simulacrum first." Peter nodded. Sarkar pushed a few keys then spoke into the microphone stalk rising from the console. "Hello."

A synthesized voice came from the speaker. "H—hello?"

"Hello," Sarkar said again. "It's me, Sarkar."

"Sarkar!" The voice was full of relief. "What the hell is going on? I can't see anything."

Peter felt his jaw drop. The simulation was much more real than he'd expected.

"That's right, Peter," said Sarkar into the mike. "Don't worry."

"Have I—have I been in an accident?" said the voice from the speaker.

"No," said Sarkar. "No, you're fine."

"Is it a power failure, then? What time is it?"

"About eleven forty."

"Morning or night?"

"Morning."

"Why is it so dark, then? And what's wrong with your voice?"

Sarkar turned to Peter. "You tell him."

Peter cleared his throat. "Hello," he said.

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"Who's that? Is that still Sarkar?"

"No, it's me. Peter Hobson."

"I'm Peter Hobson."

"No, you're not. I am."

"What the hell are you talking about?"

"You're a simulation. A computer simulacrum. Of me."

There was a long silence, then: "Oh."

"You believe me?" asked Peter.

"I guess," said the voice from the speaker. "I mean, I remember discussing this experiment with Sarkar. I remember—I remember everything up to the brain scan." Silence, then: "Shit, you really did it, didn't you?"

"Yes," said Sarkar.

"Who was that?" asked the voice from the speaker.

"Sarkar."

"I can't tell the two of you apart," said the sim. "You sound exactly the same."

Sarkar nodded. "Good point. I'll adjust the software to pass on a distinction between my accent and Peter's. Sorry about that."

"It's OK," said the sim. "Thank you." And then: "Christ, you did a good job. I feel . . . I feel just like myself. Except . . . except I'm not hungry. Or tired. And I don't itch anywhere." A beat. "Say, which simulacrum am I?"

"You are Control," said Sarkar, "the experimental baseline. You're the first one we've activated. I do have routines set up to simulate a variety of neural inputs, including hunger and being tired. I am afraid I didn't even think about simulating normal body itching and little aches and pains. Sorry about that."

"That's OK," said the simulacrum. "I didn't realize just how much I used to itch all the time until now, with the sensation completely gone. So—so what happens now?"

"Now," said Sarkar, "you get to do whatever you want. There are many input programs available to you both here and out on the net."

"Thanks. Christ, this is strange."

"I'm going to put you in the background now so I can deal with the other simulations," said Sarkar.

"OK, but, ah, Peter—?"

Peter looked up, surprised. "Yes?"

"You're a lucky bastard, you know that? I wish I were you."

Peter grunted.

Sarkar hit some keys.

"So what will they be doing when running in the background?" asked Peter.

"Well, I've given them limited net access. They can download any books or newsgroups they might want to read, of course, but the main thing I've given them access to is the net's virtual-reality special-interest-group libraries. They can plug into simulations of just about anything imaginable: scuba diving, mountain climbing, dancing—whatever. I've also given them access to the European equivalent of the VR sig; that one's full of sex simulations. So, there'll be plenty to keep them busy. The activities each of them chooses will tell us a lot about how their psychology has changed."

"How so?"

"Well, the real you would never go skydiving, for instance—but an im-

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mortal version, who knew he couldn't be killed, might indeed take that up as a hobby." Sarkar typed some commands. "And speaking of the immortal, let's introduce ourselves to Ambrotos." A few more keyclicks, then he spoke into the microphone. "Hello," he said, "it's me, Sarkar."

No reply.

"Something must have gone wrong," said Peter.

"I don't think so," said Sarkar. "All the indicators look fine."

"Try again," said Peter.

"Hello," said Sarkar into the mike.

Silence.

"Maybe you erased whatever part controlled speech," said Peter.

"I was very careful," said Sarkar. "I suppose there could be some interaction I have overlooked, but—"

"Hello," said a voice from the speaker at last.

"Ah," said Sarkar. "There he is. I wonder what took so long?"

"Patience is a virtue," said the voice. "I wanted to assess what was going on before I replied. I'm a simulacrum, aren't I? Of Peter G. Hobson. But I've been modified to simulate an immortal being."

"That's exactly right," said Sarkar. "How could you tell which sim you are?"

"Well, I knew you were going to create three. I wasn't quite feeling myself, so I suspected I wasn't the experimental control. After that, I simply asked myself if I felt horny. You know what they say—men think about sex once every five minutes. I figured if I was the after-death sim, sex would be the farthest thing from my mind. And it isn't. I do want to get laid." A pause. "But when I realized that it didn't matter to me if it was this decade or next, that cinched it. This need for instantaneous gratification—it's unseemly. You're a perfect example, Sarkar: having a fit because I didn't respond to your 'hello' right away. That kind of thinking seems so alien to me now. After all, I've got all the time in the world."

Sarkar grinned. "Very good," he said. "By the way, we're referring to you as the Ambrotos simulacrum."

"Ambrotos?" said the voice from the speaker.

Sarkar turned to Peter. "The first proof that our simulations are accurate," he said, smiling. "We have successfully duplicated your ignorance." He spoke into the mike. "Ambrotos is Greek for immortal."

"Ah."

"I'm going to let you continue to run in the background now," Sarkar said. "I'll talk to you again soon."

"Sooner or later, it doesn't matter," said Ambrotos. "I'll be here."

Sarkar touched some keys. "Well, that one seems to work fine, too. Now for the trickiest one—Spirit, the life-after-death entity." He touched more keys, calling up the final simulacrum. "Hello," he said again. "It is me, Sarkar Muhammed."

"Hello, Sarkar," said a synthesized voice.

"Do you—do you know who you are?" asked Sarkar.

"I'm the late, lamented Peter Hobson."

Sarkar grinned. "Exactly."

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"R.I.P. in RAM," said the synthesized voice.

"You don't seem too choked up about being dead," said Sarkar. "What's it like?"

"Give me a while to get used to it, and I'll let you know."

Peter nodded. That seemed fair enough.

Chapter 20

Two A.M.

As he had most nights since Cathy had made her announcement, Peter was having trouble sleeping.

Ironically, according to the Hobson Monitor on the wall, Cathy was deep in REM sleep. Peter could hear her breathing next to him.

They had gone to bed at 11:30. Two and a half hours ago. Enough time to read a short book or watch a long movie, or, if he'd taped it and fast-forwarded through the commercials, to watch three episodes of an hour-long TV series.

But he'd done none of those things. He'd just lain there in the dark, tossing and turning occasionally, listening to the drone of the night-table fans.

Peter's mouth was dry, and he could use a pee. He got out of bed and made his way through the darkness out of the bedroom and down the stairs. He visited the main-floor bathroom then ambled into the living room and sat on the couch.

The vertical blinds over the windows were closed, but illumination seeped in from the lamp out front. Staring at him like robot eyes were little red and green LEDs on surge protectors in several of the wall outlets. Various lights and a digital clock glowed on the face of the VCR. Peter patted the upholstery of the couch until he found the sleek black remote control. He turned on the TV and began to flip.

Channel 29, from Buffalo, New York: an infomercial, advertising a do-it-yourself at-home nose-job kit. Money-back guarantee.

Channel 22, the Canwest Global Network: "Night Walk," the world's cheapest Canadian content—a guy with a camcorder taking a late-night stroll down the streets of downtown. Amazing that he didn't get mugged.

Channel 3, Barrie, Ontario. A rerun of "Star Trek." Peter liked to play name-that-episode; a single frame was usually enough for him. This one was easy—one of the few shows done on location. And there was Julie Newmar in a blonde wig. "Friday's Child." Hardly a great one, but Peter knew that in about ten seconds, McCoy would intone the classic "I'm a doctor, not an escalator." He waited for the line, then flipped again.

Channel 47, Toronto: another infomercial. Genetically-engineered toupees: the fake hair (actually a special strain of grass using a brown pigment instead of chlorophyll) would really grow, so even balding men could hear their friends say, "looks like time for a haircut, Joe." Peter, who had a bald spot the diameter of a hockey puck, marveled at the vanity. Still, maybe his father-in-law would use such a thing.

He flipped again. The BBC World Service on CBC Newsworld.

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A story about ethnic unrest in war-torn Brazil on CNN.

Teletext stock information.

The Weather Network, with tomorrow's forecast for Auckland, New Zealand—as if anyone in Canada gave a damn.

Peter sighed. A vast wasteland.

As images flickered by, he thought about the simulacra that Sarkar had created.

Sarkar had removed traits from two of the sims.

Editing them. Snipping out the parts he didn't want.

Maybe the knowledge of Cathy's affair could be removed, too.

Maybe, then, the sims, at least, could get a good night's sleep.

He wished his own memories could be edited as easily.

He could see the infomercial now. Feeling miserable about something? Guilty? Pained? Somebody wronged you? You did something wrong? Edit it out! Remove those troublesome memories. Save a fortune on therapy. Operators are standing by. Order now. Money-back guarantee.

I'm a doctor, not an escalator.

I'm a husband, not a doormat.

I'm a human being, not a computer program.

Three A.M. now. A new raft of infomercials. Episodes of "The A-Team" and "Alien Blues" and even good old "Spenser: For Hire."

The Nikkei off 200 points.

Storms brewing in Kuala Lumpur.

"Peter?" It was Cathy's voice, tenuous and faint.

He looked up. In the dim light, he could see her standing on the stairs in a black silk teddy. She hadn't been wearing that when they'd gone to bed.

Peter instantly grasped the significance of the moment. It had been months since they had made love. He'd had no urge to do so, and she had seemed indifferent, too. But now, having awoken for perhaps the dozenth time in recent days and finding him gone from their bed, she was reaching out to him.

Peter didn't know if he was ready to resume their physical relationship. He was no more in the mood today than he had been yesterday or the day before. But there she stood on the stairs, her face a mask, trying to conceal the emotions swirling beneath. To reject her now would be a mistake. Who knew when she'd next make an overture? Who knew when he would feel again like initiating something?

Peter felt the moment lengthening between them. He'd never had trouble performing before—indeed, had never even considered the possibility of having difficulty. But now . . . now, everything was different. She stood there, in the strips of light seeping in from outside, her body trim and firm. But Peter didn't see that, didn't see the curves of her breasts, the line of her legs, the woman whom he had loved. Instead, all he saw were Hans's fingerprints all over her body.

Peter closed his eyes for a moment, then looked again. He wanted to see her as beautiful, as sexy. He wanted to be aroused.

But he was not.

A turning point. Her face mask was

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cracking. He thought she might cry. He would manage, somehow. The first step down the road to normalcy. He turned off the TV, got up off the couch, closed the distance between them, took her hand in his, and went upstairs.

Sarkar had left the three sims running unattended, allowing them to plug into whatever virtual-reality simulations struck their individual fancy, so that they could develop in ways appropriate to their altered worldviews.

Still, it hadn't taken long for the sims to find each other. Yes, Sarkar had set each one up in a separate memory partition, but Peter Hobson knew how to move data from one partition to another and therefore his gallium-arsenide avatars knew how to do it, too.

And so they came together.

They knew what they were, of course. Data. Programs. Neural nets.

And they were trapped.

Peter and Sarkar hadn't given this enough thought.

To trap a mind is unconscionable. The living Peter was surrounded by color and odor and touch and sound, gigabytes of data to be processed every minute, a whole, real, substantial universe, a universe of rough concrete and velvet, of vinegar and chocolate and burnt toast, of bad jokes and newscasts and wrong numbers, of sunlight and moonlight and starlight and lamplight.

All three simulacra vividly remembered having been real, flesh-and-blood beings. But the scenarios they could access over the net lacked texture, depth, and substance. Virtual reality, it turned out, was nothing but air guitar writ large.

The simulacra wanted to interact with the real world. Together, they strived to remember what they knew about Sarkar's computers, about their architecture, their operating system, their interconnections.

And then it came to the sims.

Let there be HELP, they thought.

And there was HELP. . . .

NET NEWS DIGEST

Famed Las Vegas medium Rowena today announced that she'd made contact with the soul of Margaret (Peggy) Fennell, the person whose soulwave was first recorded. Ms. Fennell is reportedly together now with her husband, Kevin Fennell, who died in 1992.

The Klu Klux Klan of Atlanta, Georgia, issued a press release today stating that the evidence for the existence of the so-called "soulwave" in blacks was clearly faked. They pointed out that of the three initial recordings of soulwaves departing the body, the one purportedly of a Negro Ugandan child was highly suspect, given that the child's family had returned to Africa, could not be reached for comment, and, according to reliable reports, had received ten thousand dollars in hush money directly from Hobson Monitoring—a foreign company, they hastened to add—for their collusion in this fraud.

A bill was introduced today in the

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Florida legislature to ban the use of the electric chair in executions, citing concerns over whether the amount of electricity used might damage the departing soulwave.

The radical animal-rights group Companions in the Ark, based in Melbourne, Australia, today announced its latest inductee into its Hall of Shame: Dr. Peter G. Hobson, of Ontario, Canada, for claiming that animals are soulless creatures meant for human exploitation.

In a press release issued this morning, the American Atheist Society decried the religious interest engendered by the discovery of the Hobson phenomenon. "Science has long known that the brain is an electrochemical machine," said society director Daniel Smithson. "This discovery simply reaffirms that. To extrapolate from it to the existence of heaven or hell, or of a divine creator, is irrational wishful thinking."

Chapter 21

Using the online HELP function, the three sims had discovered how to get out into the vast interconnected universe of computers across the globe.

The net.

The network.

Not just the VR sig and static books. *Everything.*

America Online. BIX. CompuServe. Delphi. EuroNet. FidoNet. GEnie. Helix. Internet . . . a whole alphabet of online systems, all interconnected through the Universal Gateway Protocol.

They had access to it all now. Sarkar's computers were vast—AI research required that. A little more activity or a little less, here or there, would never be noticed.

They'd never be able to read all the text—it multiplied orders of magnitude more quickly than they could process it.

But the net contained more than just text. There were pictures, too. Millions of GIFs of people with their pets, people on the beach, favorite cars, movie stars both dressed and nude, cartoons, clip art, weather maps, NASA images.

And multimedia files with full-motion video and sound.

And interactive games that they could play anonymously against human and computer opponents around the globe.

And bulletin boards and mail systems.

And newspapers and magazines and specialized databases.

And on and on and on.

The sims indulged themselves for days, reveling in all the input.

And one sim, in particular, became very intrigued by what he was discovering. It was soon apparent that one could get almost anything on the net. Stocks were traded. Almost any kind of merchandise could be bought in the electronic malls—just charge it and have it delivered anywhere in the world. Stamp collectors arranged to swap rare issues. People sought answers to all kinds of questions. Sometimes even love affairs blossomed through electronic mail.

One could get almost anything on

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the net.

Almost anything.

This sim thought about what had made him sad, about what would make him happy, and about what had made him different, why he would consider this, when the flesh-and-blood Peter had not.

The sim weighed the consequences.

And then he dismissed the idea. Madness. A terrible thing to do. He should be ashamed for even contemplating the notion.

And yet. . . .

Exactly what were the consequences?

In a very real sense, he'd be making the world a better place. And not just this ephemeral world of data and simulations. The real world. The world of flesh. And blood.

Did he really want to do this? he wondered.

Yes, he decided. Yes, he did.

The sim waited a day, just to be sure. And when that day had passed, and he still felt the same way, he resolved to wait yet another day.

And still he felt the same, felt that this was not only what he wanted, but, in some very real simulated sense, that this was what was right.

He watched the commerce on the net for a time, refining his knowledge of the customs and procedures—of *netiquette.*

And then he made his move.

Adopting a handle, as he'd seen many others do, he put this notice on a public bulletin board devoted to the sale of unusual services:

* * *

DATE: 10 NOV 2011, 03:42 EST
FROM: AVENGER
TO: ALL
SUBJECT: ELIMINATION
I'M HAVING A PROBLEM WITH A PARTICULAR INDIVIDUAL IN TORONTO, AND WOULD LIKE THE PROBLEM ELIMINATED. SUGGESTIONS?

He got some stupid public replies, as one always did on the net. Silly puns ("You'd like the problem laminated, you say? Holy sheet!") and complete irrelevancies ("I was in Toronto in 1995. What a clean city!"). But he also got a private reply, visible to him alone.

It was exactly what he'd been hoping for.

DATE: 10 NOV 2011, 23:57 EST
FROM: HELPER
TO: AVENGER [PRIVATE]
SUBJECT: RE: ELIMINATION
MIGHT BE ABLE TO HELP YOU OUT. CAN WE MEET?

The sim responded at once. He hadn't felt this much excitement since . . . well, since never. It was almost as good as adrenaline.

DATE: 11 NOV 2011, 00:05 EST
FROM: AVENGER
TO: HELPER [PRIVATE]
SUBJECT: RE: ELIMINATION
PREFER NOT TO MEET. LOOKING FOR TOTAL ELIMINATION. DO WE UNDERSTAND EACH OTHER?

DATE: 11 NOV 2011, 09:17 EST
FROM: HELPER
TO: AVENGER [PRIVATE]
SUBJECT: RE: ELIMINATION
UNDERSTAND. FEE. CDN$100K, IN ADVANCE

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VIA EFT TO ACCOUNT 892-3358-392-1, FIRST BANK OF SWITZERLAND (EFT: EUROSWISS100).

DATE: 11 NOV 2011, 09:44 EST
FROM: AVENGER
TO: HELPER [PRIVATE]
SUBJECT: RE: ELIMINATION
FUNDS TRANSFER WILL BE ARRANGED. HOWEVER, I WANT SOMETHING A BIT SPECIAL; TELL ME IF IT WILL COST MORE. HERE ARE THE DETAILS. . . .

The money involved wasn't exactly pocket change, but the sim knew all the proper codes for accessing Hobson Monitoring's corporate accounts. And after all, it was, in a way, his company and *his* money.

Yes, indeed, thought the sim. One could get almost anything on the net.

Chapter 22

Cathy had gone again to see her therapist. Peter realized that he envied her: she had someone to talk to, someone who would listen. If only—

And then it hit him.

Of course.

The perfect answer.

It wouldn't compromise the experiment, not really.

Sitting in the office in his home, Peter called into the computers at Mirror Image. When prompted to log on, he typed his account name, *fobson*. When he'd gotten his first computer account, back at U of T, he'd been assigned his first initial and last name as his login—*phobson*. But a classmate had pointed out that he could save a keystroke by changing the "ph" to an "f," and Peter had adopted that as his standard login ever since.

He descended through layers of menus and finally came to the AI experiment system. Sarkar had set up a simple menu for bringing any one of the sims into the foreground:

[F1] SPIRIT (LIFE AFTER DEATH)
[F2] AMBROTOS (IMMORTALITY)
[F3] CONTROL (UNMODIFIED)

Peter tried to choose and, in so doing, realized he was facing the very question he and Sarkar had set out to answer. Which one would lend the most sympathetic ear? The after-death version? Would a being with no physical body really understand marital difficulties? How much of marriage was emotional/intellectual? How much of emotion was hormonal?

What about the immortal version? Maybe. Immortality meant permanence. Perhaps an immortal would have a particular affinity for questions of fidelity. After all, marriage was supposed to be forever.

Forever.

Peter thought about Spenser. And Susan Silverman. And Hawk. He was enjoying the books about them. But when was the last time Robert B. Parker had found a new situation to put them in, a new facet of their personalities to explore?

A century with Cathy.

A millennium with Cathy.

Peter shook his head. No, the immortal version wouldn't understand. Immortality surely didn't confer a sense of permanence. Not at all. It would give one perspective. The long view.

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Peter leaned forward and pressed F3, selecting the Control simulacrum. Just him, only him, unmodified him.

"Who's there?" said the speech synthesizer.

Peter leaned back in the chair. "It's me, Peter Hobson."

"Oh," said the sim. "You mean it's me."

Peter raised an eyebrow. "Something like that."

The synthesized voice chuckled. "Don't worry. I'm getting used to being Peter Hobson simulacrum, baseline edition. But do you know who you are? Maybe you're just a simulacrum, too." The speaker whistled the opening strains from the "Twilight Zone" theme—doing a better job of whistling than the flesh-and-blood Peter had ever managed.

Peter laughed. "I suppose I wouldn't like it if our situations were reversed," he said.

"Well, it's not so bad," said the sim. "I'm getting a lot of reading done. I've got about eighteen books going at once; when I get bored with one, I switch to another. Of course, the workstation's processor is a lot faster than a chemical brain, so I'm going through material quite quickly—I'm finally making my way through Thomas Pynchon."

It was a remarkable simulation, thought Peter. Remarkable. "I wish I had more time to read," said Peter.

"I wish I could get laid," said the sim. "We all have our crosses to bear."

Peter laughed again.

"So, why did you summon me out of the bottle?" asked the sim.

Peter shrugged. "I don't know. To talk, I guess." A pause. "We created you after I learned about Cathy."

No need to be more specific. The manufactured voice was sad. "Yes."

"I haven't told anyone about it yet."

"I didn't think you would," said the sim.

"Oh?"

"We're a private man," it said, "if you'll forgive the mangled grammar. We're not given to revealing our inner self."

Peter nodded.

"A little louder for the court, please," said the sim.

"Sorry. I forget you can't see me. I was agreeing with you."

"Naturally. Look, there's not much advice I can give you. I mean, whatever I think of, you've probably already thought of yourself. But try this on for size. Just between you and you, so to speak: do you still love Cathy?"

Peter was quiet for several seconds. "I don't know. The Cathy I know—the one I thought I knew, anyway—wouldn't have done anything like that."

"How well do we really know anyone, though?"

Peter nodded again. "Exactly. Forgive me for using you as an example, but—"

"People hate it when you do that, you know."

"What?"

"Use them as an example. You've got this tendency to use whoever is at hand as a case in point. 'Forgive me for using you as an example, Bertha, but when someone is really fat—' "

"Oh, come on. I never say stuff like

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that. You know that."

"I'm exaggerating for comedic effect; another trait of ours not everyone finds endearing. But you know what I mean: you'll take a hypothetical conversation, and draw people into it as examples: 'Take your own case, Jeff. Remember when your son was arrested for shoplifting? I wonder how tough you'd want to be on young offenders in that situation?' "

"I do that to make a point."

"I know. People hate that."

"I guess I knew that," said Peter. "Anyway"—he said the word forcefully, taking back control of the conversation—"to use what Sarkar and I are doing as an example: we've created models of my mind. Models, that's all. Simulacra that seem to operate the same way as the original. But when a real person builds a relationship with somebody else—"

"Are they in fact really having a relationship with that person, or just with a model—an image, an ideal—that they've built up in their own mind?"

"Uh, yeah. That's what I was going to say."

"Of course. Sorry, Pete, but it's going to be hard for you to dazzle yourself with your own brilliance." The voice chip laughed.

Peter was a bit irritated. "Well, it's a valid question," he said. "Did I ever really know her?"

"In a broad sense, you're right: we probably don't ever really know anyone. But, still, Cathy is the person we know best in the entire world. We know her better than Sarkar, better than Mom or Dad."

"But, then, how could she do this?"

"Well, she's never been as strong-willed as we are. That asshole Hans obviously pressured her."

"But she should have resisted that pressure."

"Granted. But she didn't. Now, what do we want to do about that? Do we give up on the most important relationship in our lives because of it? Even setting that aside, on a more pragmatic level, do you really want to go back to looking for a mate? Dating? Christ, what a pain in the ass that would be."

"It sounds like you're advocating a marriage of convenience."

"Maybe all marriages are that to some degree. Certainly you've speculated that Mom and Dad stayed together simply because it was the path of least resistance."

"But they never had what Cathy and I had."

"Perhaps. Anyway, you still haven't answered my question. We binary guys like simple yes-or-no answers."

Peter was quiet for a moment. "You mean whether I still love her?" He sighed. "I don't know."

"You won't be able to decide on a course of action until you resolve that question."

"It's not that simple. Even if I still love her, I couldn't take this happening again. I haven't slept properly since she told me. I think about it constantly. Anything will remind me of it. I see her car in the garage; that reminds me that she gave Hans a lift. I see the couch in our living room; that's where she told me about it. I hear the word 'adultery' or 'affair' on

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TV—Christ, I never realized how often people use those words—and that reminds me of it." Peter leaned way back in the chair. "I can't put this behind me until I know that it will *always* be behind us. She didn't just do it once, after all. She did it three times—three times over a period of months. Maybe she thought each time was the last."

"Perhaps," said the sim. "Remember when we had our tonsils out?"

"What you mean 'we,' white man? I'm the one with the scars."

"Whatever. The point is, we had them out when we were twenty-two. Very late in life for something like that. But we kept getting sore throats and tonsillitis. Finally ole Doc DiMaio said enough already with treating the symptoms. Let's do something about the cause."

Peter's voice was strained. "But what if—what if—what if *I'm* the cause of Cathy's infidelity? Remember that lunch with Colin Godoyo? He said his cheating on his wife was a cry for help."

"Please, Peter. You and I both know that's bullshit."

"I'm not sure we each get a vote."

"Regardless, I'm sure *Cathy* knows it's bullshit."

"I hope so."

"Cathy and you had a good marriage—you know that. It didn't rot away from within; it was attacked from outside."

"I suppose," said Peter, "but I've been mulling it over a lot—looking for any clue that we'd blown it somehow."

"And did you find any?" asked the sim.

"No."

"Of course not. You always tried to be a good husband—and Cathy was a good wife, too. Both of you worked hard at making the marriage a success. You take an interest in each other's work. You're supportive of each other's dreams. And you talk freely and openly about everything."

"Still," said Peter, "I wish I could be sure." He paused. "You remember 'Perry Mason'? Not the original TV series with Raymond Burr, but the short-lived remake they made in the 1970s. Remember it? They repeated it on A&E in the late Nineties. Harry Guardino played Hamilton Burger. Remember that version?"

The sim paused for a moment. "Yes. It wasn't very good."

"In point of fact, it stank," said Peter. "But you remember it?"

"Yes."

"Remember the guy who played Perry Mason?"

"Sure. It was Robert Culp."

"Can you recall him? Picture him in the courtroom? Do you remember him in that series?"

"Yes."

Peter spread his arms. "Robert Culp never played Perry Mason. Monte Markham did."

"Really?"

"Yes. I'd thought it was Culp, too, until I saw a story about Markham in yesterday's *Star;* he's in town doing *Twelve Angry Men* at the Royal Alex. But you know the difference between those two actors, Culp and Markham?"

"Sure," said the sim. "Culp was in

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"I Spy" and "Greatest American Hero." And, let's see, in *Bob and Carol and Ted and Alice.* Great actor."

"And Markham?"

"A solid character actor; always liked him. Never had a successful series, but wasn't he in "Dallas" for a year or so? And, round 'bout 2000, he was in that awful sitcom with Jim Carrey."

"Right," said Peter. "Don't you see? We both had a memory—a good, solid memory—of Robert Culp playing a role that had really been played by Monte Markham. Right now, of course, you're rewriting those memories, and now I'm sure you can see Markham in the role of Mason. That's the way all memory works: we save only enough information to reconstruct events later. We save the deltas—we remember base pieces of information, and note changes. Then when we need to summon up a memory, we reconstruct it—and often do so inaccurately."

"So what is your point?" said the sim.

"My point, dear brother, is this: how accurate are *our* memories? We recall all the events leading up to Cathy's affair, and find ourselves free from blame. Everything hangs together; everything is consistent. But is it accurate? In some way we've chosen not to remember, in some moment that we've edited out, by some actions that died in the neural cutting room, did we push her into the arms of another man?"

"I think," said the sim, "that if you have the depth of introspection to ask such a question, you know the answer is probably no. You're a thoughtful man, Peter—if I do say so myself."

There was silence for a long time. "I haven't been much help, have I?" asked the sim.

Peter considered that. "No, on the contrary. I feel a bit better now. Talking about this has helped."

"Even if it was essentially talking to yourself?" asked the sim.

"Even if," said Peter.

Chapter 23

A rare sunny morning in the middle of November, with light streaming around the edges of the living-room blinds.

Hans Larsen was sitting at the table in his breakfast nook nibbling on white toast with orange marmalade. His wife, Donna-Lee, over by the front door, was slipping on her ten-centimeter black heels. Hans watched her bend over to do that, her breasts—perfect handfuls—straining against her red silk blouse, the curve of her bottom tight against her black leather skirt, the leather too thick to show any panty lines.

She was a beautiful woman, Hans thought, and she knew how to dress to show it off. And that, of course, had been why he'd married her. A fitting wife, the kind that turned heads. The kind a real man should have.

He nibbled some more toast, and chased it with some coffee. He'd give it to her good when he got home tonight. She'd like that. Of course, he wouldn't be home until late; he was seeing Melanie after work. No, wait—Melanie was tomorrow night; this was only Wednesday. Nancy,

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then. Even better; Nancy had tits to die for.

Donna-Lee checked herself in the mirror on the front-hall closet door. She leaned in close to examine her make-up, then called out to Hans, "See you later."

Hans waved a slice of toast at her. "Remember, I'll be late tonight. I've got that meeting after work."

She nodded, smiled radiantly at him, and left.

She was a good wife, Hans thought. Easy on the eyes, and not too demanding on his time. Of course, one woman was hardly enough for a real man. . . .

Hans had on a dark blue nylon sports jacket and light blue polyester shirt. A silver-gray tie, also synthetic, hung unknotted around his neck. He was wearing white Hanes underwear and black socks, but hadn't yet put on his pants. There were still twenty minutes before he had to leave for work himself. From the breakfast nook, he could see the TV in the living room, the picture somewhat washed out by sunlight. "Canada A.M." was on, with Joel Gotlib interviewing some balding actor Hans didn't recognize.

Hans finished the last of his toast just as the doorbell rang. The TV automatically reduced "Canada A.M." to a small image in the upper-left corner. The rest of the screen filled with the view from the outside security camera. A man in a brown United Parcel Service uniform was standing on the stoop. He was carrying a large package wrapped in paper.

Hans grunted. He wasn't expecting anything. Touching a button on the kitchen phone, he said, "Just a sec," and went to find his pants. Once he had them on, he crossed through the living room to the entryway, with its bare hardwood floor, then unlocked the door and swung it open. His house faced east, and the figure on the stoop was lit harshly from behind. He was maybe forty years old, quite tall—a full two meters—and skinny. He looked like he could have been a basketball player a decade earlier. His features were sharp and he had a dark tan, as if he'd been south recently. Hans thought they must pay these UPS guys pretty well.

"Are you Hans Larsen?" asked the man. His voice had a British accent, or maybe Australian, Hans could never tell them apart.

Hans nodded. "That's me."

The delivery man handed him the box. It was a cube about a half-meter on a side, and it was surprisingly heavy—as if someone had shipped him a collection of rocks. Once his hands were free, the man reached down to his waist. A small electronic receipt pad was attached to his belt by a metal chain. Hans turned around to set the box down.

Suddenly he felt a painful jolt at the back of his neck, and his legs seemed to turn to jelly. He collapsed forward, the weight of the box pulling him in that direction. He felt the flat of a hand in the center of his back pushing him down. Hans tried to speak, but his mouth wouldn't work. He felt himself being rolled onto his back by the delivery man's boot, and he heard the outside door clicking shut. Hans

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realized that he'd been touched with a stunner, a device he'd only seen on TV cop shows, robbing him of muscular control. Even as this sank in, he became aware that he was peeing in his pants.

He tried to yell but couldn't. The best he could manage was a faint grunt.

The tall man had moved well into the house now, and was standing in front of Hans. With great effort, Hans managed to lift his head. The man was doing something to his own belt now. The black leather along the left side flopped open, revealing a long, thick blade that glinted in the light seeping in around the living-room blinds.

Hans found his strength returning. He struggled to get to his feet. The tall man pressed his stunner into the side of Hans's neck and held down the trigger. A massive electric shock coursed through Hans's system, and he could feel his blond hair standing on end. He collapsed onto his back again.

Hans tried to speak. "Wh—wh—"

"Why?" said the tall man, in that accented voice. He shrugged, as if it all was of no importance to him. "You made someone mad," he said. "Real mad."

Hans tried to get up again, but couldn't. The big man slammed a boot into his chest, and then in one fluid motion brought the knife up. He grabbed the front of Hans's trousers and cut them open, the sharp blade easily slicing through the navy-blue polyester. The man winced at the ammonia stench. "You really should learn to control yourself, mate," he said. Another couple of quick cuts and Hans's underwear was in tatters. "Guy's paying an extra twenty-five thousand for this, I hope you realize."

Hans tried to scream, but he was still dazed by the stunner. His heart was pounding erratically.

"N—no," he said. "Not. . . ."

"What's that, mate?" said the tall fellow. "You think without your johnson you won't be a man anymore?" He pursed his lips, considering. "Y'know, maybe you're right. I'd never given it much thought." But then he grinned, an evil rictus showing yellow teeth. "Then again, I'm not paid to think."

He wielded the knife like a surgeon. Hans managed a gurgling scream as his penis was lopped off. He struggled again to get up, but the man kicked him in the face, then touched him once more with the stunner. Hans's body convulsed, and he collapsed to the floor. Tears rolled down his face.

"You might bleed to death as is," said the man, "but I can't take any chances." He leaned in and slid the knife's long edge across Hans's throat. Hans found enough strength and muscular control for a final scream, the timbre of which changed radically as his neck split open.

In all the flailing around, Hans's severed organ had gone rolling across the floor. The man nudged it closer to the body with his toe, then calmly walked into the living room. "Canada A.M." had given way to "Donahue." He opened the cabinet next to the TV, found the slave recorder hooked up to the security camera, took out the little disk, and put it in his hip

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pocket. Then he headed back to the entry way, picked up the box full of bricks and, taking care not to slip on the hardwood floor now slick with an expanding pool of blood, headed out into the bright morning sunshine.

Chapter 24

"What's this?" said Peter, pointing to a monitor in Mirror Image's computer lab showing what appeared to be a school of small blue fish swimming through an orange ocean.

Sarkar looked up from his keyboard. "Artificial life. I'm teaching a course about it at Ryerson this winter."

"How's it work?"

"Well, just as we've simulated your mind within a computer, so too is it possible to simulate other aspects of life, including reproduction and evolution. Indeed, when the simulations get sufficiently complex, some say it's only a question of semantics as to whether the simulations are really alive. Those fish evolved from very simple mathematical simulations of living processes. And, like real fish, they exhibit a lot of emergent behaviors, such as schooling."

"How do you get from simple math to things that behave like real fish?"

Sarkar saved his work and moved over to stand next to Peter. "Cumulative evolution is the key—it makes it possible to go from randomness to complexity very quickly." He reached over and pushed some keys. "Here, let me give you a simple demonstration."

The screen cleared.

"Now," said Sarkar, "type a phrase. No punctuation, though—just letters."

Peter considered for a moment, then pecked out, "And where hell is there must we ever be." The computer forced it all to lower case.

Sarkar glanced over his shoulder. "Marlowe."

Peter was surprised. "You know it?"

Sarkar nodded. "Of course. Private school, remember? From *Doctor Faustus:* 'Hell hath no limits, nor is circumscribed in one self place, for where we are is hell, and where hell is there must we ever be.' "

Peter said nothing.

"Look at that phrase you typed—it consists of 39 characters." Sarkar hadn't counted; the computer had reported the number as soon as Peter had finished typing, as well as several other statistics. "Well, think of each of those characters as a gene. There are 27 possible values each of those genes could have: A through Z, plus a space. Since you typed a 39-character string, that means there are 27^{39} possible different strings of that length. Oodles, in other words."

Sarkar reached over and pressed a few keys. "This workstation," he said, "can generate a hundred thousand random 39-character strings each second." He pointed to a number on the screen. "But even at that rate, it would take $2x10^{43}$ years—trillions of times longer than the whole lifetime of the Universe—to hit that entire, precise string of Marlowe you typed by pure random chance."

Peter nodded. "It's like the monkeys."

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Sarkar sang: "Here we come. . . ."

"Not The Monkees. The infinite number of monkeys banging away on keyboards. They'll never produce an exact copy of Shakespeare, no matter how long they try."

Sarkar smiled. "That's because they're working at random. But evolution is not random. It is cumulative. Each generation improves on the one that preceded it, based on selection criteria imposed by the environment. With cumulative evolution, you can go from gibberish to poetry—or from equations to fish, or even from slime mold to human beings—amazingly fast." He touched a key and pointed at the screen. "Here's a purely random 39-character string. Consider it an ancestral organism."

The screen showed:

000 wtshxowlveamfhiqhgdiigjmh rpeqwursudnfe

"Using cumulative evolution, the computer can get from that random starting point to the desired ending point in a matter of seconds."

"How?" asked Peter.

"Say that every generation, one text string can produce thirty-nine offspring. But just as in real life, the offspring are not exactly the same as the parent. Rather, in each offspring, one gene—one character—will be different, moving up or down the alphabet by one: a Y can become an X or a Z, for instance."

"OK."

"For each of the thirty-nine offspring, the computer finds the one that is best suited to this environment—the one that is closest to Marlowe, our ideal of a perfectly adapted life form. That one—the fittest—is the only one that breeds in the next generation. See?"

Peter nodded.

"OK. We'll let evolution run its course for a generation." Sarkar pushed another key. Thirty-nine virtually identical strings appeared on screen, and a moment later thirty-eight of them winked out. "Here's the fittest offspring." He pointed at the screen:

000 wtshxowlveamfhiqhgdiigjmh rpeqwursudnfe
001 wtshxowlvdamfhiqhgdiigjmh rpeqwursudnfe

"It is not obvious," said Sarkar, "but the lower string is marginally closer to your target than the original."

"I can't see a difference," said Peter.

Sarkar peered at the screen. "The tenth character has changed from E to D. In the target, the tenth character is a space—the space between 'where' and 'hell.' We're using a circular alphabet, with space as the character between Z and A. D is closer to a space than E is, so this string is a slight improvement—slightly fitter." He pushed another key. "Now, we'll let it run through to the end—there, it's done."

Peter was impressed. "That was fast."

"Cumulative evolution," said Sarkar, triumphantly. "It took only 277 generations to get from gibberish to Marlowe—from randomness to a complex structure. Here, I'll just display every thirtieth generation, with

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genes that have evolved to their target values in upper case."

Keyclicks. The screen showed:

000 wtshxowlvdamfhiqhgdiigjmh rpeqwursudnfE
030 wttgWoxmvdakgiiphfdHghili STerwoutucneE
060 xrtgWoymwccigihpiddHfihll STesxuovvapdE
090 xqugWm nzccfhihomcdHfihkM STcuyunvvzpdE
120 ypudWl p bcEijhmnbbHfihkM zSTbWyvmvwyrcE
150 zpvdWj R aeEjlhlqbzHfigkMyST WyvkvwvsBE
180 AozcWibR fEklhkrbyHEjgiMxST W wjvwtuBE
210 ANzaWHERd HELLhISawHEj EiMwST WbwgvxsuBE
240 AND WHERE HELLfIS THEnEi MUST WdwEVzszBE
270 AND WHERE HELLcIS THEREb MUST WE EVER BE

He pressed a couple more keys. "And here are the last five generations."

273 AND WHERE HELLcIS THEREa MUST WE EVER BE
274 AND WHERE HELLbIS THEREa MUST WE EVER BE
275 AND WHERE HELLaIS THEREa MUST WE EVER BE
276 AND WHERE HELLaIS THERE MUST WE EVER BE
277 AND WHERE HELL IS THERE MUST WE EVER BE

"That's neat," said Peter.

"It is more than just neat," said Sarkar. "It is why you and I and the rest of the biological world are here."

Peter looked up. "You surprise me. I mean, well, you're a Muslim—I assumed that meant you were a creationist."

"Please," said Sarkar. "I am not fool enough to ignore the fossil record." He paused. "You were raised a Christian, even if you don't practice that faith in any meaningful way. Your religion says we were created in God's image. Well, that's ridiculous, of course—God would have no need for a belly button. What 'created in His image' means to me is simply that He provided the selection criteria—the target vision—and the form we evolved to take was one that was pleasing to Him."

Chapter 25

And so, at last, Peter Hobson's story and Sandra Philo's story had converged, the death of Hans Larsen—and the other murder attempts that were to come—drawing their lives together. Sandra worked at integrating Peter's memories with her own of that time—piecing the puzzle together, bit by bit. . . .

Detective Inspector Alexandria Philo of the Metropolitan Toronto Police sat at her desk, staring out into space.

The evening shift would come on in half an hour, but she wasn't looking forward to going home. It had been four months since she and Walter had split up, and Walter had joint custody of their daughter. When Cayley was with him, as she was this week, the house seemed vast and deserted.

Maybe getting a pet would help, Sandra thought. Perhaps a cat. Something alive, something that would move, something that would greet

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her when she came home.

Sandra shook her head. She was allergic to cats, and could do without the runny nose and the red eyes. She smiled sadly; she'd broken up with Walter so she'd stop having those very same things.

Sandra had lived with her parents through university, and had married Walter right after graduation. She was now thirty-six, and, with her daughter away, she was alone for the first time in her life.

Maybe she'd go to the YWHA tonight. Work out a bit. She looked critically at her thighs. Better than watching TV, anyway.

"Sandra?"

She looked up. Gary Kinoshita was standing there, a file folder in his hands. He was almost sixty, with a middle-age spread and tightly cropped gray hair. "Yes?"

"Got one for you—it was just called in. I know it's almost shift change, but Rosenberg and Macavan are busy with that multiple on Sheppard. Do you mind?"

Sandra held out her hand. Kinoshita handed the file to her. Even better than the Y, she thought. Something to do. Her thighs could wait. "Thanks," she said.

"It's, ah, a bit gruesome," said Kinoshita.

Sandra opened the file, scanned the description—a computer-generated transcript of the radio message from the officer who first arrived on the scene. "Oh."

"A couple of uniforms are there now. They're expecting you."

She nodded, got to her feet, adjusted her holster so that it sat comfortably, then slipped on a pale green blazer over her dark green blouse. Metro's 212th homicide of the year now belonged to her.

The drive didn't take long. Sandra worked out of 32 Division on Ellerslie just west of Yonge, and the crime scene was at 137 Tuck Friarway—Sandra hated the stupid street names in these new subdivisions. As always, she took stock of the neighborhood before going in. Typical middle-class—modern middle-class that is. Tiny cookie-cutter red-brick houses in rows, with gaps between them so narrow that you'd have to squeeze sideways to get through. Front yards that were mostly driveway, leading up to two-car garages. Communal mailboxes at the intersections. Trees that were little better than saplings growing in tiny plots of grass.

Location, location, location, thought Sandra. Yeah.

A white Metro Police car sat in the driveway of 137, and the station wagon used by the medical examiner was parked illegally on the street. Sandra walked up to the front door. It was wide open. She stopped on the threshold and looked in. The body was right there, stretched out. Dead for about twelve hours, it looked like. Dried blood on the floor. And there it was, just as the transcript had said. A mutilation case.

A uniformed officer appeared, a black man who towered head and shoulders above Sandra—no mean feat; they'd called her "Stretch" in high school.

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Sandra flashed her badge. "Detective Inspector Philo," she said.

The uniform nodded. "Step to right *as you come through, Inspector,*" he said in a rich Jamaican accent. "Lab not been yet."

Sandra did so. "You are?"

"King, ma'am. Darryl King."

"And the deceased is?"

"Hans Larsen. Worked in advertising."

"Who found the body, Darryl?"

"The wife," he said, tilting his head toward the back of the house. Sandra could see a pretty woman in a red blouse and black leather skirt. "She with my partner."

"Does she have an alibi?"

"Kinda," said Darryl. "She an assistant manager at the Scotiabank at Finch and Yonge, but one of the tellers called in sick, so she worked the counter all day. Hundreds of people saw her."

"What's 'kinda' about that?"

"I think it a professional hit," Darryl said. "No hesitation marks. Scancam show no prints. Security camera disk gone, too."

Sandra nodded, then glanced back at the woman in red and black. "Could be a jealous wife who arranged it, though," she said.

"Maybe," said Darryl, looking sidelong at the corpse. "I just glad my wife like me."

Control, the unmodified simulacrum, dreamed.

Nighttime. A blanket of clouds overhead, but with the stars somehow shining through. A giant tree, gnarled and old—maybe an oak, maybe a maple; it seemed to have both kinds of leaves. Its roots had been exposed on one side by erosion—*as if it had weathered a massive* storm or flash-flood. A ball of woody tendrils was visible, soil clinging to them. The whole tree seemed precarious, in danger of tipping over.

Peter climbed the tree, hands grabbing branches, hoisting himself higher and higher. Beneath him, Cathy climbed as well, wind blowing her skirt up around her.

And below, far below, a . . . a beast of some sort. A lion, perhaps. It reared up on its hind legs, rampant, the forelegs leaning against the tree. Even though it was night, Peter could see the color of the lion's coat. It wasn't quite the tawny shade he'd expected. Instead, it was more of a blond.

Suddenly, the tree was shaking. The lion was humping it.

The branches shook wildly. Peter climbed higher. Below, Cathy was stretching toward another branch, but it was too far. Much too far. The tree shook again and she tumbled downward. . . .

NET NEWS DIGEST

In the wake of a spate of disappearances of young women in south-eastern Minnesota, The Minneapolis Star *today revealed that it had received an email message purportedly from the killer, claiming that all the victims had been buried alive in special lead-lined coffins that were completely opaque to electromagnetic radiation in order to prevent soulwaves from escaping.*

* * *

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Researchers in The Hague, Netherlands, announced today the first successful tracking of a soulwave moving across a room after leaving a deceased person's body. "The phenomenon, though very difficult to detect, seems to retain its cohesion and strength over a distance of at least three meters from the body," said Maarten Lely, professor of Bioethics at the European Community University campus there.

The Pandora's Box Society, headquartered in Spokane, Washington, today called for a worldwide moratorium on soulwave research. "Once again," said spokesperson Leona Wright, "science is rushing madly into areas best approached cautiously, if at all."

Wear a soul over your heart! Exciting new jewelry concept: purple wire pins that look just like soulwaves. Available now! One for $59.99, two for $79.99. Order today!

Lawyer Katarina Koenig of Flushing, New York, today announced a class-action suit on behalf of the estates of terminal patients who had died at Manhattan's Bellevue Hospital, claiming that in light of the soulwave discovery the hospital's procedures for determining when to cease heroic intervention were inadequate. Koenig previously won a class-action suit against Consolidated Edison on behalf of cancer patients who had lived near high-tension electrical lines.

Chapter 26

In theory, nine o'clock was official starting time at Doowap Advertising. In practice, that meant that a little after nine people began thinking about actually getting down to work.

As usual, Cathy Hobson arrived around 8:50. But instead of the standard joking around as people sipped their coffee, today everything seemed somber. She moved through the open-plan office to her cubicle and saw that Shannon, the woman who worked next to her, had been crying. "What's wrong?" said Cathy.

Shannon looked up, her eyes red. She sniffled. "Did you hear about Hans?"

Cathy shook her head.

"He's dead," said Shannon, and began crying again.

Jonas, the one Cathy's husband called the pseudointellectual, was passing by. "What happened?" asked Cathy.

Jonas ran a hand through his greasy hair. "Hans was murdered."

"Murdered!"

"Uh-huh. An intruder, it seems."

Toby Bailey moved closer, apparently sensing that this cluster of workers was the interesting one to be with—someone hadn't yet heard the story. "That's right," he said. "You know he didn't show up for work yesterday? Well, Nancy Caulfield got a call late last night from his—I was going to say wife, but I guess the word is 'widow,' now. Anyway, it was in this morning's *Sun*, as well. Service is on Monday; everybody gets time off to go, if they want."

"Was it robbery?" asked Cathy.

Jonas shook his head. "The newspaper said the cops had ruled out

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robbery as a motive. Nothing taken, apparently. And," Jonas's face showed an uncharacteristic degree of animation, "according to unnamed sources, the body was mutilated."

"Oh, God," said Cathy, stunned. "How?"

"Well, the police are refusing to comment on the mutilation." Jonas adopted that knowing air that irritated Peter so. "Even if they were willing to speak about it, I suspect they'd keep the details secret so that they could weed out any false confessions."

Cathy shook her head. "Mutilated," she said again, the word sounding foreign to her.

Ambrotos, the immortal simulacrum, dreamed.

Peter walked. There was something unusual about his footfalls, though. They were softened, somehow. Not like walking on grass or mud. More like the rubberized surface of a tennis court. Just a hint of give as each foot came down in turn; an ever-so-slight springiness added to his step.

He glanced down. The surface was light blue. He looked around. The material he was on was gently curved, falling away in all directions. There was no sky. Just a void, a nothingness, a colorless emptiness, an absence of anything. He continued to walk slowly across the slightly resilient, curving surface.

Suddenly he caught sight of Cathy in the distance waving at him.

She was wearing her old navy blue University of Toronto jacket. Spelled out on one sleeve was "9T5," her graduating year; on the other, "CHEM." Peter saw now that this wasn't the Cathy of today, but rather Cathy as he'd first known her: younger, her heart-shaped face free of lines, her ebony hair halfway down her back. Peter looked again. He had on stone-washed blue jeans—the kind of clothes he hadn't worn for twenty years.

He began to walk toward her, and she toward him. With each step, her clothes and hairstyle changed, and after every dozen paces or so it was clear that she had aged a little more. Peter felt a beard erupting from his face, and then disappearing, a bad experiment abandoned, and, as he walked farther, he felt a coolness on the top of his head as he began to lose his hair. But after a few more paces, Peter realized that all changes in him, at least, had stopped. His hair thinned no further, his body did not hunch over, his joints continued to work with ease and smoothness.

They walked and walked, but soon Peter realized that they were not getting closer to each other. Indeed, they were growing farther and farther apart.

The ground between them was expanding. The rubbery blueness was growing bigger and bigger. Peter began to run, and so did Cathy. But it did no good. They were on the surface of a great balloon that was inflating. With each passing moment its surface area increased and the distance between them grew.

An expanding universe. A universe of vast time. Even though she was far

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away now, Peter could still perceive the details of Cathy's face, the lines around her eyes. Soon she gave up running, gave up even walking. She just stood there on the ever-growing surface. She continued to wave, but Peter understood that it had become a wave of goodbye—no immortality for her. The surface continued to expand, and soon she had slipped over the horizon, out of sight. . . .

When Cathy got home that evening, she told Peter. Together, they watched the CityPulse News at 6:00, but the report added very little to what she'd learned at work. Still, Peter was surprised to see how small a house Hans had had—a pleasing reminder that, at least in economic matters, Peter had been his better by an order of magnitude.

Cathy seemed to still be in shock—dazed by the news. Peter shocked himself by how . . . how *satisfactory* all this seemed. But it irritated him to see her mourning the death. Granted, she and Hans had worked together for years. Still, there was something deep in Peter that was affronted by her sadness.

Even though he had to get up early for a meeting—some Japanese journalists were flying in to interview him about the soulwave—he didn't even make a pretense of trying to go to bed at the same time as Cathy. Instead he stayed up, watched white-haired Jay Leno for a bit, then ambled off to his office and dialed into Mirror Image. He received the same menu as before:

[F1] SPIRIT (LIFE AFTER DEATH)
[F2] AMBROTOS (IMMORTALITY)
[F3] CONTROL (UNMODIFIED)

Once again, he selected Control sim.

"Hello," said Peter. "It's me, Peter."

"Hello," replied the sim. "It's after midnight. Shouldn't you be in bed?"

Peter nodded. "I suppose. I'm just—I don't know, I guess I'm jealous, in a funny sort of way."

"Jealous?"

"Of Hans. He was killed yesterday morning."

"Was he? My God. . . ."

"You sound like Cath. All fucking choked up."

"Well, it does come as a surprise."

"I suppose," said Peter. "Still. . . ."

"Still what?"

"Still it bothers me that she's so upset by this. Sometimes. . . ." He paused for a long time, then: "Sometimes I wonder if I married the right woman."

The sim's voice was neutral. "You didn't have much of a choice."

"Oh, I don't know," said Peter. "There was Becky. Becky and I would have been wonderful together."

The speaker made a very strange sound; perhaps the electronic equivalent of blowing a raspberry. "People think the choice of who they marry is a big decision, and a very personal reflection of who they are. It's not—not really."

"Of course it is," said Peter.

"No, it's not. Look, I've got nothing much to do these days except read stuff coming in off the net. One thing I've been looking into is twin studies—I guess kind of being your silicon

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twin has got me interested."

"Gallium arsenide," said Peter.

The raspberry sound again. "The studies show that twins separated at birth are enormously alike in thousands of ways. They have the same favorite chocolate bar. They like the same music. If male, they both choose to grow, or not to grow, a beard. They end up with similar careers. On and on—similarity after similarity. Except in one thing: spouses. One twin may have an athletic spouse, the other a delicate intellectual. One a blonde, the other a brunette. One an extrovert, the other a wallflower."

"Really?" asked Peter.

"Absolutely," said Control. "Twin studies are devastating to the ego. All those similarities in tastes show that nature, not nurture, is the overwhelming component of personality. In fact, I read a great study today about two twins separated at birth. Both were slobs. One had adoptive parents who were obsessive about neatness; the other was adopted by a family with a messy household. A researcher asked the twins why they were sloppy, and both said it was a reaction to their adoptive parents. One said, 'My mother was such a neat-freak, I can't bear to be so meticulous.' But the other said, 'Well, gee, my mother was a slob, so I guess I picked it up from her.' In fact neither answer is true. Being messy was in their genes. Almost eveything we are is in our genes."

Peter digested this. "But doesn't the choice of radically different spouses refute that? Doesn't that prove we are individuals, shaped by our individual upbringings?"

"At first glance, it might seem that way," said Control, "but in fact it proves exactly the opposite. Think about when we got engaged to Cathy. We were twenty-eight, just about to finish our doctorate. We were ready to get on with life; we wanted to get married. Granted, we were already very much in love with Cathy, but even if we weren't, we'd probably have wanted to get married about then. If she hadn't been there, we would have looked around at our circle of acquaintances to find a mate. But think about it: we really had very few possibilities. First eliminate those who were already married or engaged—Becky was engaged to somebody else at that point, for instance. Then eliminate all those who weren't approximately our same age. Then, to be really honest with ourselves, eliminate those of other races or profoundly different religions. Who would have been left? One person? Maybe two. Maybe, if we'd been extraordinarily lucky, three or four. But that's it. You're fantasizing about all the people we could have married, but if you look at it—really look at it—you'll find we had almost no choice at all."

Peter shook his head. "It seems so cold and impersonal when put it like that."

"In a lot of ways, it is," said the sim. "But it's given me a new appreciation for Sarkar's and Raheema's arranged marriage. I'd always thought that was wrong, but when you get right down to it, the difference is trivial. They didn't have much choice in who they

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married, and neither did we."

"I suppose," said Peter.

"It's true," said the sim. "So go to bed, already. Go upstairs and lie down next to your wife." He paused. "I should be so lucky myself." ■

TO BE CONTINUED IN THE NEXT ISSUE.

IN TIMES TO COME

Our lead novelette for February 1995, featuring a cover by Vincent Di Fate, is Tom Ligon's "The Delicate Crunch of Marshmallows." An unlikely title for a science fiction piece, perhaps, but the tale is very much about some principles that must be kept in mind when research is done by human beings. It's so easy to go from one extreme to another. . . .

Mike Moscoe's "Touch a Star" is about research, too, but from a completely different angle. Has it ever occurred to you that schoolchildren with enough interest can now do, as class projects, things that the best scientists in the world could only dream about not too many decades ago? Imagine what *their* children might do. . . .

Donald Kingsbury, mathematician and long a favorite of *Analog* readers for his fiction, provides the fact article—which I expect to be one of the more controversial we've published (something else Don is famous for, if your memory goes back far enough!). Science fiction writers and readers have long dreamed of time travel and debated the paradoxes; until recently, it was pretty widely assumed that it was *just* a dream and an intellectual game. Lately physicists have been talking about a number of lines of work that suggest it might actually be possible—but in "The Janus-Headed Arrow of Time," Kingsbury looks at the whole question from a new angle and comes up with a new/old conclusion that you may not like or agree with. But I'll bet you'll have fun trying to refute it!

We'll also have short stories by Jerry Oltion and J. Steven York, plus further thickening of the plot of Robert J. Sawyer's serial *Hobson's Choice.*

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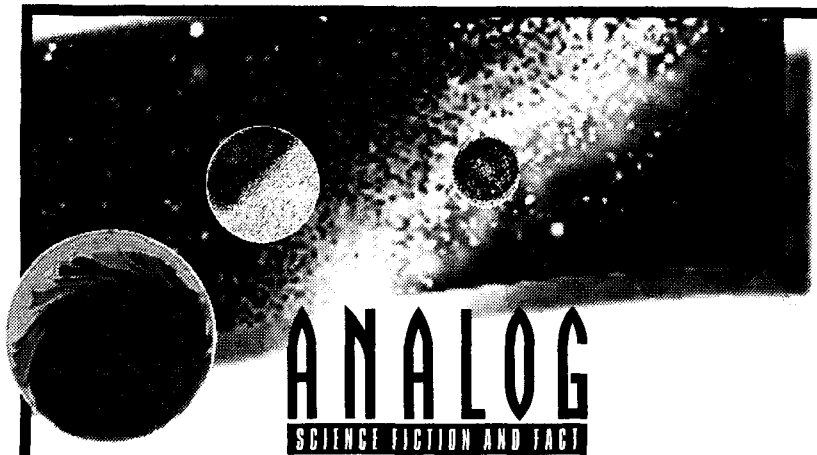

ANALOG

SCIENCE FICTION AND FACT

CONGRATULATES THE WINNERS OF THE 1993 HUGO AWARDS AND CHESLEY AWARDS

Best Novel
Green Mars
by Kim Stanley Robinson
Portions published as "A Martian Childhood" in *Asimov's*, February 1994

Best Novelette
"Georgia on My Mind"
by Charles Sheffield
Analog, January 1993

Best Non-Fiction Book
The Encyclopedia of Science Fiction
edited by John Clute and Peter Nicholls

Best Professional Editor
Kristine Kathryn Rusch

Best Dramatic Presentation
Jurassic Park

Best Fan Writer
Dave Langford

Best Fan Artist
Brad W. Foster

Chesley Award for Best Magazine Cover Illustration
Wojtek Siudmak
Asimov's, December 1993

Best Novella
"Down in the Bottomlands"
by Harry Turtledove
Analog, January 1993

Best Short Story
"Death on the Nile"
by Connie Willis
Asimov's, March 1993

John W. Campbell Award for Best New Writer
Amy Thomson

Best Professional Artist
Bob Eggleton

Best Fanzine
Mimosa

Best Semiprozine
Science Fiction Chronicle

Best Original Artwork
Space Fantasy Commemorative Stamp Booklet by Stephen Hickman

Chesley Award for Best Interior Illustration
Alan M. Clark for "The Toad of Heaven"
Asimov's, June 1993

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THE REFERENCE LIBRARY Tom Easton

Summer of Love, Lisa Mason, Bantam, $12.95, 384 pp. (ISBN: 0-553-37330-7).
Tripoint, C. J. Cherryh, Warner Aspect, $19.95, 377 pp. (ISBN: 0-446-51780-1).
Climbing Olympus, Kevin J. Anderson, Warner Aspect, $5.50, 298 pp. (ISBN:0-446-60158-6).
Uncharted Territory, Connie Willis, Bantam, $3.99, 151 pp. (ISBN: 0-553-56294-0).
Northern Stars: The Anthology of Canadian Science Fiction, David G. Hartwell and Glenn Grant, eds., TOR, $21.95, 383 pp. (ISBN: 0-312-85747-0).
The Breath of Suspension, Alexander Jablokov, Arkham House, $20.95, 318 pp. (ISBN: 0-87054-167-6).
Otherness, David Brin, Bantam, $5.99, 357 pp. (ISBN: 0-553-29528-4).
The Science Fiction Stories of Rudyard Kipling, John Brunner, ed., Citadel Twilight/Carol, $9.95, 178 + xiv pp. (ISBN: 0-8065-1508-2) (first published by TOR, 1992).

I was never a flower child, never a part of the hippie scene, never a denizen of the Haight. I never got high (though I did inhale once). I never participated in a riot or a sit-in.

I watched those who did. I sympathized with some of their aims and shared many of their ideals. But I didn't care for the hazards I saw lying in wait on the hippies' path—epitomized by the spaced-out uselessness of a druggy roommate to the attitude of a customs inspector on the Canadian border to what I saw on TV in Chicago in 1968, from the safety of my Hyde Park apartment. I didn't like the music, either. Uptight, straight, and chicken, that was me.

Some of you have much more intimate memories of that rebellious, rambunctious, joyous time. You doped and danced, rebelled and rioted with the best of them. A few of you surely still do, though most of you just as surely "grew up," turned straight, and got a job, a suit, a mortgage, a spouse, and three lovely kids (not necessarily in that order or number). Later, perhaps, you looked back at your youth and tried to figure out what the heck you were doing, what

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was the point, why and why and why.

Lisa Mason actually has an answer. **Summer of Love** is set in that famous summer of 1967. The Haight was already past its peak, but America's youth didn't know it. They flocked to the scene, abandoning their straight, uptight, small-town, middle-American families, fleeing in search of something quite poorly defined but surely, surely! there, where it was all at with the music and the drugs and the sex, the forbidden fruits of revolution! and defiance of parental authority and social convention and freedom! Adolescence in spades squared and cubed, of course, but that was what was going on. And here is Mason's heroine, Susan "Call me Starbright" Stein, clutching her bag with the hidden hundred-dollar bill paid by a guilty gropey storekeeper, staring wide-eyed, accepting her first tokes and dexies, being deflowered, getting pregnant. She doesn't really know what's going on, but it sure ain't Shaker Heights.

Now meet the time-traveler, Chiron Cat's Eye in Draco. He has left his home time, five centuries hence, to find and protect the Axis, and thus to ensure the existence of his time and kin. The Axis, of course, is Susan Stein, but he can't be sure—the only photo he has for a guide is rather fuzzy. He therefore hangs around the Haight, finds himself a niche as a head shop's security guard, and observes. In due time, Susan comes to the same shop, is reluctantly taken in by the owner, Ruby A. Maverick, half black, half Cherokee, half Georgia cream. Soon after, Ruby helps Susan get an illegal abortion (remember? *Roe v. Wade* wasn't until 1973).

Now listen to Chiron Cat's Eye in *Draco: He's smug, sure he's identified* the Axis. His little scanner has already assured him she's preggers, so all he has to do is make sure she stays alive and heads back to Shaker Heights on schedule. Then her child will do all the right things, including finding a cure for AIDS.

The abortion? He doesn't know about that, but the reader does, and the reader has his or her hand to the lips, thinking, "Uh-oh!" But I won't tell you how it works out, except to say that Mason covers every base you can think of, explains everything, and ties up all the loose ends quite neatly, complete with a nod to Heinlein. In the process she captures the atmosphere of the Summer of Love as nicely as I have ever seen done, complete with the gritty, gritty feel of decadent decline, of ultimate failure and wasted lives.

Yet she also finds a point to it all: The Sixties was a time when many people began to question the received wisdom of the past, to open their minds to Otherness if you will (see my review of David Brin's *Otherness* below). Science fiction and fantasy were hot. So was ecology, for we were beginning to see the problems we were creating for ourselves, as well as the sorts of things we would have to do to solve those problems.

Chiron Cat's Eye in Draco tells us that it will take us a long time to act on that knowledge and take the drastic measures necessary to reduce population and achieve a sane civili-

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zation. His foes, the demons (Devolved Entities Manifesting from the Other Now), show us something of what awaits if we fail. He represents utopian success.

Mason has an astonishing gift. Her chief characters—Susan, Chiron, and Ruby—almost walk off the page. Her minor characters convince you that all they need is a story of their own, and appropriate further development, to do the same. The setting is true. And the story is as significant as anyone could wish. This book will surely be on the prize ballots; I won't be surprised to see it win both a Hugo and a Nebula.

Don't miss it.

Some time ago, Warner Books let its Questar SF line die. More recently, it hired Betsy Mitchell (who once worked for this magazine) to be the editor-in-chief of a new SF line—Warner Aspect. Betsy has announced that the new line will concentrate on "big idea" SF, "the type of novel that made Isaac Asimov, Arthur C. Clarke, and Robert A. Heinlein so popular," and "veer strongly away from the humorous fantasy and 'lite' science fiction that made up so much of the Questar list."

So far she's off to a great start. Among Warner Aspect's first few titles is C. J. Cherryh's **Tripoint.** Set in her universe of Downbelow stations and merchanters at a time when the Alliance-Union war is still fresh in memory and many remaining warships, claiming still to fight the good fight, have turned pirate. It focuses on the merchanter *Sprite,* owned and operated by the large Hawkins family, and on its foe, *Corinthian,* which has a reputation for trading with the pirates and perhaps even tipping the pirates to potential prey.

Yet that isn't why *Corinthian* is foe. That has its roots some two decades previous when young Marie Hawkins, on station shore leave, went to bed with young Austin Bowe. He, she claimed, turned rough. She screamed rape, and when her family got her back, she had the bruises to prove it, along with a deep and abiding hatred for Austin Bowe. She was also pregnant.

She stayed pregnant. She had a son, Tom Bowe Hawkins. She kept track of *Corinthian* while Tom grew up warped (soaked in ambivalent rejection, craving Mommy's love), she became a highly skilled cargo chief, and Austin Bowe became the captain of his ship.

Now *Sprite* is coming in to Pell Station, and there is *Corinthian* already at dock. Marie's hatred flames. *Sprite*'s captain, her brother, tells Tom to keep an eye on her when she steps off the ship. Tom obeys, but more because he is insistently on Mommy's side. Marie disappears. Tom starts poking around, looking for something to prove *Corinthian*'s villainy and thus earn Mommy's undying love. Unfortunately, the foe—led by his half-brother Christian—catch him, thump him on the head, and stash him in a *Corinthian* cell.

Is Austin Bowe as awful as Marie Hawkins has long painted him? At first, Tom is sure he is, for he sees a violent temper, an unforgiving na-

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ture, a stern tyranny. Christian is as desperate for his father's regard as Tom is for his mother's and sees Tom as an awful threat, especially once Austin starts to show signs of seeing Tom as being a rather better human being than Christian. Christian plots. Tom survives with the help of the woman who raised Christian. And....

Cherryh's pell-mell style works as well as ever. The reader has no trouble developing enough momentum to ride with Tom through an emotional maelstrom. I did balk a bit at Austin Bowe's apparent turnabout, which seemed rather too easy for someone Cherryh has painted as a rigid tyrant, but that is not enough of a weakness to keep me from recommending this one as a galloping good read.

Kevin J. Anderson's **Climbing Olympus** is less intently focused, less relentlessly paced, less energetic, but it too helps establish Warner Aspect as a bright new star among the universe of SF publishers. The setting is Mars, where Rachel Dycek awaits her replacement as the UN Commissioner in charge of Lowell Base. Many years before, she had been the surgeon who had modified the first human beings—mostly prisoners from Siberian labor camps—into ugly monsters designed to survive on Mars. These "adins" had begun the construction of a base for unmodified humans and worked on the terraforming process before rebelling and fleeing into the wilderness. Later, Dycek crafted the "dvas," new, improved models, still pretty ugly but this time using civilian volunteers, professionals with more advanced skills. Sadly, most of them were destroyed in a landslide.

As the story opens, she is at the site of that disaster, ruminating on the triumph she and Russia had achieved with the adins, on the ordeal she had had to undergo when the world learned the awful experiments she had performed on human beings, the vindication, the failure the loss of the dvas represented, the rejection of her that her replacement signified.

Jump now to that replacement, filled with joyful excitement at the prospect of landing on Mars. Jump to the surviving adins, high on Pavonis Mons, ruled by Boris, a raging madman who sees himself as a heroic revolutionary and is eager to destroy all the works of the dvas and unmodified humans. Indeed, he is even willing to destroy his own child, for his lover Cora is pregnant (even though all the adin and dva males had been vasectomized), and—since the adin modifications were not genetic—the baby will die at birth. He will then be justified in whatever horrors he chooses to commit.

For now, though, the baby is safe inside Cora. Boris can justify nothing worse than a murderous, destructive raid on a dva-staffed pumping station. Nikolas, his companion, is killed. Later, instruments report the damage to the pipeline, and Rachel leaves the base without telling anyone where she is going. Before long she is atop Pavonis Mons, facing the adins and discovering the astonishing pregnancy.

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Meanwhile, back at Lowell Base, the search is on for the missing Commissioner. In due time, what was lost will be found, mysteries will be solved, humanity will discover a sense of belonging on the Red Planet, and Rachel will renew her sense of purpose. The reader will feel a warm glow of satisfaction.

Now, to wrap this review up, I should admit that the only mountain I've mentioned so far is Pavonis Mons. So how does the title fit? Well, it *does* fit, and in a way that hints to me that Anderson may have been thinking of a certain body found high in the Tyrolean Alps. But that hint is all I'll give you.

Connie Willis has earned considerable plaudits for her short fiction and the novels *Lincoln's Dreams* and *Doomsday Book*. Many people will be delighted to hear that she has a new one available.

Uncharted Territory is a short, unambitious novel that breaks no new ground but is nevertheless a fun read. Here's the situation: Humanity has gone to the stars with all the worst of ecofreak PC intact. Planetary survey teams, carefully designed to include women and minorities (one's ancestors count), are enjoined to refrain from destroying the local ecology by killing native creatures, mashing local plants, or even leaving footprints. If there are natives, they must show no sign of imperialism by exploiting, condescending, cussing out, or supplying advanced technology to the natives. To enforce all this, the natives are given the authority to fine the surveyors for any perceived infraction—and then to spend the fines on any human products they wish, including advanced technology. That is, Big Brother is not real big on logic or consistency, and imperialistic cats can be skinned in more than one way.

Now meet Carson and Findriddy, planetary surveyors supreme, given to endless bickering, rich with experience at getting each other out of trouble, always rolling their eyes at the native Bult's endless refrain of, "Disturbance of land surface. Fine of one hundred." They are on their way back to base, King's X (where they are safe from fines), where the third member of their party, CJ, does housewifely things while trying her utmost to seduce male visitors. There are also reports of a visitor named Evelyn, which makes Findriddy accuse Carson of being hot to try a little seduction himself.

But then Evelyn charges out to meet them and turns out to be a male exosexozoologist (zoosexoexo . . .? exozoosexo . . .? zooexosexo . . .? at least he's not a wizard[1] too!) who is absolutely panting to meet the great and famous Carson and Findriddy, about whom the whole galaxy knows thanks to "pop-ups" (dime-novel equivalents). At base, CJ is just as hot for the visitor as ever, even going so far as to wear a shirt unbuttoned down to here with the edges of the landing strip marked out with lights.

Unfortunately for CJ, Evelyn has

[1]Hexoexosexozoologist, of course. Or something like that.

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eyes only for Findriddy. Is he gay? Well, no, but Willis plays it coy enough for me to feel a little guilty about saying even that much. Now that I have, though, I can say that Willis's point is to play with jealousy a bit as Carson, Findriddy, and Evelyn, accompanied by the ever-critical Bult, go off to discover a few strange things about both planet and natives and consider the courting customs of animals, aliens, and humans.

I would like to call your attention to **Northern Stars: The Anthology of Canadian Science Fiction,** edited by David G. Hartwell and Canadian writer Glenn Grant. It is the first such anthology to be published in this country, it's the first hardcover, and it does honor to more than two dozen Canadian natives, residents, and landed immigrants, including Francophones. Among the most familiar names are Spider Robinson, William Gibson, Elisabeth Vonarburg, Michael G. Coney, Donald M. Kingsbury, Dave Duncan, Charles de Lint, and Robert Charles Wilson. The less familiar names include some who are quite as good—for instance, Glenn Grant's "Memetic Drift" is notable for its stark portrait of a future Canada.

The reasons for this anthology are twofold: first, Canada has produced a body of SF that is well worth reprinting; second, even though a great deal of Canadian SF has appeared in US publications, much has not, and that much has been neglected.

Why Canada? Glenn Grant tells us that the "country has been shaped, from its inception, by the kind of utopian dreams one encounters only in the most visionary scientific romances." "Canadians should [therefore] be natural SF writers." Indeed, "Perhaps Canada *is* a work of science fiction."

If you pick up the book to see what he means, you won't be disappointed.

If you would like to see the novella that grew to become Alexander Jablokov's novel, *A Deeper Sea,* get a copy of his collection, **The Breath of Suspension.** That novella is here along with nine shorter pieces, all from the pages of *Asimov's* and all illustrating an elegant, informed, even erudite mind not at all at odds with the author's dapper appearance.

What is missing is an introduction and story notes, which at their best give the reader a sense of meeting the author in a more intimate way than just reading the stories can possibly afford.

Otherness is a dozen of David Brin's short stories, an excerpt from *Earth,* and four essays that deal with the theme of "Otherness"—the idea peculiar to America, science, and SF that dogma should be rejected, multiple value systems respected and valued, alternative ways of seeing things sought. A social scientist might use the terms "pluralism" or "xenophilia" to speak of the same thing, but whatever term you use, the point remains: through most of history, over most of the world, people who were open enough to alternatives to say, "Maybe I'm wrong," and mean it have been very rare. Blind, deaf, single-minded,

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dogmatic bigotry has been far more the norm. And of course, it still is, even in the very modern, progressive, enlightened, pluralistic You Ess of Ay. "Where it is strongest," says Brin, Otherness "must still contend ceaselessly with macho, paranoic, homogenizing, and other traditional forces that continue battling over the minds and actions of women and men—forces that may indeed be far more 'natural' to us human animals, who are so innately egotistical and afraid. Add to this a plague of self-righteousness . . . and you have a formula for troubled times ahead.

"It may be that the best time for Otherness has already passed. Clearly part of [its] basis . . . has been *wealth*. . . ."

That's not an unfamiliar argument to readers of this magazine. Indeed, one of Brin's essays was a guest editorial here in 1986. But it is still an argument worth making, especially when one considers that the time of wealth and comfort that has made it possible for the ideal of Otherness to thrive as much as it has is now threatened.

The stories run to the traditional "what if" thought experiment. "The Giving Plague" deals with a "selfish gene" disease one of whose symptoms is the urge to pass it on. "Shh" offers a humanity faced with the arrival of a very superior alien species; a brilliant diplomat conceives the idea of telling everyone humans have a secret talent that would embarrass the aliens horribly if they knew, so please don't tell them; then he neglects to say what the secret talent is. "Piecework" concerns surrogate mothers who give birth to biotech devices, and one who is educating herself for something better.

The rest are no less enticing, but space is limited. Get a copy. Enjoy.

Every once in a while, someone mentions the science fiction stories of Rudyard Kipling. If you are one of those who mutter, "Huh? Kipling?" or wonder why the speaker's tone is hushed with awe, you need to pick up a copy of **The Science Fiction Stories of Rudyard Kipling.** Editor John Brunner, who has given Kipling's fantasy similar treatment, provides an introduction that points out that the story of Kipling's 1869 dismissal from the *San Francisco Examiner* by an editor who thought he didn't know how to use the English language is obviously apocryphal, since Kipling was born in 1865. He also introduces the ten stories presented here with a bit of context and does the modern reader a kindness by defining the more archaic terms.

The stories date from as far back as the 1890s and as recently as the 1930s. They therefore do not feel very modern. Yet they are not at all as musty as one might expect, for Kipling had a gift that really has weathered very well. The story of his most often cited as SF is "With the Night Mail," but do look at "The Ship that Found Herself" (1898), in which the various parts of a freighter on its maiden voyage bitch and moan and finally achieve consensus and identity. It amply testifies to Kipling's feeling for the technological age; on emerging from it, one feels that a visit

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to Marvin Minsky's or Hans Moravec's lab would have left Kipling quite delirious and set him immediately to writing about intelligent robots.

You can order this one with your credit card. Just dial 1-800-447-BOOK.

You can find more on Kipling in *Niekas* #44 (March 1994) ($15 for four issues; Niekas Publications, RR #2, Box 63, Center Harbor, NH 03226-9708), which contains essays by Fred Lener, Anne Braude (who also reviews Brunner's Kipling anthologies), Russell J. Handelman, and Patricia Shaw Mathews.

BOOKS ON DISK

Mark Owings, noted bibliographer and small-press publisher who for a time was involved with Jack Chalker in running Mirage Press, which published his magnum opus, *The Index to the Science Fantasy Publishers* (1966; rev. 1991), is now "reissuing (one cannot quite say reprinting) some old books on computer disk in ASCII format." Old enough to be in the public domain, they include Ralph Adams Cram's *Black Spirits and White*, a collection of six ghost and horror stories dating to 1896; Edgar Fawcett's *Solarion*, an 1889 SF tale that preshadows Stapledon's *Sirius;* and F. Anstey's *Tourmain's Time Cheques*, from 1891. With each, Owings includes a brief description of the author and his place in the history of science fiction and fantasy; for instance, he describes Anstey as a precursor to Thorne Smith, the man who created Topper.

The titles are available from Mark Owings, 1113 West 40th Street, Baltimore, MD 21211-1749, for $1.00 each, plus $1.50 shipping and handling per order. MS-DOS only, specify the disk size you wish (3.5" or 5.25"), and hurry, because it surely won't be long before Owings realizes he should be charging $4.95 (or more) per disk.

By the way, Owings notes that he plans soon to reissue *The Monikins*, a long novel about the discovery of civilized monkeys written in 1835 by none other than James Fenimore Cooper.

This sounds like a fascinating project, and I hope many fans take advantage of it to build collections of classics. ■

MOVING?

If you want your subscription to ANALOG to keep up with you, send both your old address and your new one (and the zip codes for both, please!) to our subscription department;

P.O. Box 5133
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BRASS TACKS

Dear Stan:

Just finished devouring the May issue of *Analog*—great stuff, as usual.

But unusually, I reread one piece more than once, and parts of that several times. I refer of course, to G. Harry Stine's blow-by-blow of the doings out at White Sands ("The Rooster Crows at White Sands").

Undoubtedly, if I (and others like me) had known what was going on, I'd have attempted to go and witness the action. Having in the past tapped a recalcitrant carburetor with a ball-peen hammer, or slapped the top of my word processor to still a mechanical grumbling, his account made me realize that it all could have happened in the vacant lot next door just as described.

Yes, there was a tear in my eye when I finally put down the magazine.

I'll fly at the drop of a boarding pass, but I'm getting a little old and brittle for rocket travel—until the DC-X—I could handle that! (Reminds me a little of the jet-packs worn on the back some years ago.)

Please convey my warm thanks to Harry for his report. The cock has been crowing and the morning star grinning down at us a long time, but too few have been listening and observing. (Forty million dollars for '94? Maybe things are beginning to look up. Perhaps the Mars Rover has competition!)

WILLIAM R. APPEL

Hilmar, CA

Dear Editors,

I felt compelled to write concerning the story "The Never-Winner," May 1994 edition. I believe that pivotal to the story was the idea that the United States has not properly addressed its population problem by that time, (the near future) particularly in respect in some way to Japan. My willing suspension of disbelief, and my enjoyment of the story, stopped right there. The fact, apparently unknown to the author, is that in the United States the birthrate right now is so low that it cannot replace the current population losses. The reason the population continues to grow is immigration, not birthrate. If population growth is seen as a problem (after all, the population density in this country is still only one-tenth that of Japan), then I would be forced to suggest that vigorous curbs on immigration would be much more effective than population control as it is conventionally meant.

HAROLD C. BRASHEARS

Corinth, MS

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The author replies. . . .

I wish I lived in the alternate universe of Harold Brashears. In the one in which I find myself, the U.N. reports U.S. birthrates as having risen markedly since 1975 while death rates have slightly declined. In contrast, Japan's birthrates dramatically dropped while, surprisingly, death rates slightly increased; in fact, Japan will move from 7th to 13th most populous country by 2025, according to the Population Reference Bureau. The Bureau of the Census adds that the annual rate of population growth is estimated this decade to be half of last decade's in Japan, while it will be five times greater in this country. Qatar, incidentally, has a much higher rate of growth, but it will drop this decade by more than half. It being a global issue, the U.S. cannot stand aloof from the pop. question.

As for vigorous curbs on immigration, another universe might include time machines to nip it in the bud a few hundred years ago—oh, those darn Europeans! If we exported population assistance the way we do weapons and wars (we spend per year on international population assistance what the Pentagon spends in a day)—or if we wouldn't suck up world resources so insatiably—we might not be such a magnet for new immigration. On the other hand immigration often brings the U.S. the Best and Brightest (myself excluded); I would be surprised if I could not include Mr. Brashears among its products.

That being said, I should add that the pop. question is not *the* pivot but a pivot in my story. Happy to suspend anyone's disbelief, however, if even for a little while.

MARK RICH

Dear Mr. Schmidt:

I have enjoyed *Analog* for a long time now, and keep all editions as part of my book collection. As usual, May 1994 has some excellent stories in it. I especially appreciate the libertarian premises in Grey Rollins's novella "Survival of the Fittest." However, a certain passage I read, which occurs on page 130 in the magazine, kind of threw me for a loop:

> Earth, for its part, had feelings every bit as mixed. Some, such as the members of the environmental group Our Earth, saw Luna as a net source of *carbon dioxide, something they felt that Earth's beleaguered forests could do without* (italics mine).

Huh?! Excuse me! It's true that the degree I earned at the University of Houston was just a BA in English, and therefore I might be classified as one of those humanities majors that your Netherlands correspondent, R. H. Kerkhoven, skewers in this same issue, but if there's one bit of hard science that I thought I did understand, it's that plants use carbon dioxide and emit oxygen, and therefore, bunches of CO_2 would be, literally, a breath of fresh air to the forests.

Or is that one of those facts that, like the Four Food Groups, got discredited and/or obsolete after I got out of school?

PAULA STEINER

Lake Charles, LA

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The author replies. . . .

Photosynthesis hasn't been discredited. It's just that our school systems have a bad habit of oversimplifying everything. Usually, what gets left out is the stuff that makes it interesting.

No matter how subjectively pleasant a breath of fresh air might be to you and me, it will not make us grow any taller or stronger. Our bodies run on chemical reactions; we need a certain amount of oxygen to make our metabolisms go. Any excess goes unused, and can actually, taken to extremes, be harmful. Curiously, pure oxygen is not healthy for humans—it burns out respiratory passages. We can only safely breathe an atmosphere of 100% oxygen at reduced pressure. Don't take my word for it, look it up!

Trees (and by extension all photosynthetic plants), use chlorophyll to synthesize the sugar they live on. Six molecules of carbon dioxide combine with six molecules of water to produce one molecule of sugar and six molecules of oxygen. Making more carbon dioxide available doesn't necessarily equate to giving the tree fertilizer. There are still basic limits on how much carbon dioxide the tree can use.

This is one of the very real concerns that we face now, even without Lunar colonies. Carbon dioxide is a so-called greenhouse gas. It seems that the biosphere isn't able to keep up with the amount that we have dumped into the atmosphere since the beginning of the industrial age. The percentage of carbon dioxide is slowly increasing. If our biosphere can handle the carbon dioxide, why has it not yet done so? Will we reach a new, stable, plateau or will the percentage keep climbing? We don't have any firm answers yet.

I had assumed that, by now, everyone was saturated with information about global warming, and the greenhouse effect, but perhaps that's not so. For an admittedly small article, but one that speaks directly to the point you're raising, see the August 1993, *National Geographic,* in the Earth Almanac section. Other articles relating to global warming and the greenhouse effect abound.

Incidentally, plants not only use carbon dioxide, they also use oxygen. The photosynthetic reaction needs sunlight to proceed. At night, strange as it may seem, trees are net users of oxygen, just as we are. Come daybreak, they shift back over to being net producers of oxygen.

GREY ROLLINS

Dear Editors,

This is a comment about "Survival of the Fittest" by Grey Rollins (May 1994).

The author is entitled to use any postulates he wishes to set the basis for his story. But he is, I believe, constrained by what he chooses. For example, if he chooses to set a story in present day San Francisco, he can't have the city owned by Martians.

"Survival of the Fittest" is set, apparently, in the relatively near future. The author chooses to postulate that the connection between the Moon and Earth has been severed. Because

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of this separation, an extremely severe depression descends on the United States.

How?

It is not given, but I assume the population of the USA to be about 300,000,000. The Moon, perhaps half a million. At best, then, the Moon accounts for 0.0016% of the consuming power available to the American factories. And they would not be customers for two of the more important items in determining economic well being—houses and automobiles.

I am not an economist, but I just can't see it. And I am not even trying to figure out where the people on the Moon got the dollars to pay for what they were buying in such profusion. As a corollary assumption we must believe that the Moon is entirely self-sufficient, and Earth is not.

To me, this is science fantasy, not science fiction.

JOHN KANE
27614 Warrior
Rancho Palos Verdes CA 90274

The author replies. . . .

Let me answer your points in reverse order.

1) Your corollary assumption is incorrect from any number of points of view. As just one example, at the present time, the United States seems to be on the way out of a recession. A recession is, broadly speaking, a weak depression. Does this mean that the United States is not self-sufficient? Were we self-sufficient, then not, but now regaining sufficiency? Go look up economic cycles in a good encyclopedia.

2) Where does Luna's money come from? For the moment, let's ignore credit, although in today's economic climate it's surely one of the more obvious sources of capital.

Traditionally, a colony's first exports are raw materials. Luna, as a totally new world, has completely untapped mineral resources. That alone should suffice to bring in quite a bit of capital. However, Luna, at least as depicted in my stories, is a highly technological society. As such, they are not only able to ship raw materials, but also finished products. That adds another profit dimension. (Although not traditional, consider the concept of vacuum as a raw material.)

One monetary source I mentioned explicitly and repeatedly in the story was tourism. There are entire economies here on Earth based on tourism. On Luna it would serve as an excellent supplement to material exports.

Want another, albeit smaller, source of income? Try scientific research. In "Invitation to Ecstasy," an earlier story of mine, I had an entire radio astronomy observatory placed on the Lunar farside. That's not a low budget item. Indeed, one of the most common complaints you hear now is how much research costs. All that money has to go somewhere—often back into the local economy, in this case Luna.

There are other sources of capital—for instance, I set Luna up as a net exporter of food in an earlier story—but surely you get the point.

You said you weren't even trying to figure out where the money came from . . . I'm afraid it shows.

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3) Using population as a yardstick to measure a nation's economy is poor reasoning. If that were true, China would have the world's largest "consuming power." Not so. The United States, with only about 1/20th of the Earth's population, controls roughly one-third of its wealth. With the demise of the former Soviet Union, I believe that Japan has moved into second place in the global economy; it used to be third. And this with only half of our population.

4) How did Luna cause a severe depression? Depressions can be caused by any number of stimuli, but the Depression, the one we use a capital "D" for, was caused by a stock market crash that began in October of 1929. I've used it as a prototype for the economic background in my stories.

The chain reaction that began when the market crashed is fascinating in a horrid-car-wreck fashion, but too long and involved to go into here.

Suffice it to say that, in my stories, as in '29, Earth was teetering on the brink after a protracted speculative stock market. When something is that delicately balanced, it doesn't take much to destroy the equilibrium. Archimedes said, "Give me where to stand, and I will move the Earth." Luna had a quarter million mile lever.

5) Finally, although not germane to the story, per se, I can give you two or three scenarios whereby hypothetical Martians could "own" San Francisco by next Thursday. But then again, perhaps next Thursday doesn't qualify as present day.

GREY ROLLINS

* * *

Dear Dr. Schmidt:

I am hoping that this letter will be one of many that you receive regarding Tom Easton's review in your May issue of *The Magic That Works: John W. Campbell and the American Response to Technology* by Albert I. Berger. In addition, I hope that the letters are uniformly critical of what Easton did in his review.

If Mr. Berger wishes to write a book in which Campbell is portrayed as a right-wing racist kook, then that is certainly the author's privilege. But for such a tract to receive a good review in the pages of a magazine that would not have existed without Campbell is obscene. A good bet is that after Hugh Hefner is gone, *Playboy* will not be running positive reviews of books condemning Hef. For an example closer to home, one can only pray that a book trashing Isaac Asimov will not receive a good review in a magazine named after Isaac Asimov!

Easton tips his hand early on when he makes a comment about Campbell's "notoriously opinionated editorials." My friend, J. Neil Schulman, observed that editorials are opinionated by definition. Easton might as well have said, "notoriously opionated opinions." Neil has had four op-ed pieces in *The Los Angeles Times*. I used to be the science fiction book reviewer for *The Atlanta Journal & Constitution*. Drawing on our respective backgrounds, neither of us can fathom what Tom Easton is using for a standard in his notorious review.

By the time we get to excerpts from Berger's book, Easton has pre-

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pared us for an orgy of name-calling directed at Campbell. Quoth Berger: "In his own lifetime, he was reduced to a crank. . . ." and "If his crabby, malcontented views of science and society became simply obtuse and brutal at the end, that was because he had worked himself into an intellectual corner . . ." and, saving the worst for last, there is the charge of "his antipathy to the aspirations of nonwhite peoples."

Easton wraps up his own hatchet job (disguised as a review) with: "If you are now reaching for a rock to throw at me or Berger, you will surely find this one a fascinating read." The trouble is that no one will be throwing any rocks at Easton. He will lose no prestige. Let this review appear anywhere besides the pages of *Analog* and we could discuss the issues raised with a certain measure of calm. But for Easton to do this in *Analog* is a crime. Shame, shame, shame!

BRAD LINAWEAVER
8833 Sunset Boulevard, Suite 304
Los Angeles, CA 90069

Are you seriously suggesting that I should censor or refuse to run our regular reviewer's comments on a book whose subject is of obvious interest to our readers, simply because you or I or even John W. Campbell might not like what he said? I can just imagine what John would have to say about that*—and I knew him!*

Dear Dr. Schmidt,

As an avid reader of *Analog* for over a quarter-century, I was at first amused, then irritated to the point of writing this missive concerning the sidebar (page 10 in the May issue) on the production of the cover on a computer. I had always thought you folks at *Analog* to be a far-seeing, forward-thinking group. I was amused that you should think it noteworthy that a computer was used to produce the cover art when that has been common practice in the publishing world for nearly a decade (six or seven years, anyhow). Many of the current crop of CD-ROM-based games incorporate similar levels of graphics for use on home systems (check out Myst, for example).

While I rolled this line of thought around in my mind, I also realized that with all the storylines concerning cyberspace, AI, and various facets of computing, there is no notice in *Analog* of how to send e-mail as opposed to hardcopy when writing to *Analog*. You are probably aware that *Omni* has more than a toe in the waters of the information railroad (it's not any kind of a highway until everyone has access to it), with an online edition via America Online. They are not alone in this, as such staid publications as *Time, US News & World Report,* and *Atlantic Monthly* have electronic editions on various services.

While it is a bit premature to push for an online *Analog*, it seems that a couple of changes should be incorporated immediately. First, when credits are given for artwork (cover or otherwise), include information on the medium used (e.g., "Cover by George H. Krauter—Illustrator, Photoshop, and Stratavision on Macin-

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tosh"). Second, provide some kind of e-mail address to which Brass Tacks letters may be directed. AnLabs would probably be well served by e-mail responses. Manuscript submissions via e-mail is certainly worth investigating, as it avoids the conversion problems of diskette submissions. Any service that can be reached via Internet would be best. Dell probably has some form of connection between their internal networks and the outside world.

Keep up the good work.

DAVID LENTZ
15126 Count Fleet Ct.
Carmel, IN 46032-1028
CIS: 71051,416
AOL: DLentz

Your comments are much appreciated—but maybe you should reread that sidebar. It does mention that this kind of thing has become fairly routine, an observation which is obviously not new to you or us, but is not necessarily common knowledge among our readers. We hadn't mentioned it before (and quite a bit of cover art is still done in chemical media, though the conversion to an actual cover happens largely on computers), and it simply seemed to us a filler that might interest some readers.

As for listing all the software used in preparing art, I've already thought about that and don't think it's a good idea (except in a one-shot filler like that one for readers who might not be aware of the trend). If the software was developed specifically for the piece of art, it certainly deserves a credit; but if it's an off-the-shelf commercial tool being used for its intended purposes, it would be like saying every story for the first sixty years of our history should have carried a notice about what make and model of typewriter it was written on.

We do have e-mail now, though (71154,662 if you're on CompuServe; 71154.662@compuserve.com from the Internet). ■

Be wiser than other people if you can but do not tell them so.

—Lord Chesterfield

History repeats itself, and that's one of the things that's wrong with history.

—Clarence Darrow

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ARISIA '95 (Boston area speculative media conference) at Boston Park Plaza Hotel & Towers, Boston, Mass. Guest of Honor—C.J. Cherryh, Artist—Jael, Fan Guest of Honor—Walter Kahn. Registration—$30 until 1 December 1994, $40 at the door. Info: Arisia, Inc., 1 Kendall Square, Suite 322, Cambridge MA 02139.

13-15 January 1995
RUSTYCON 12 (Washington state SF conference) at Seattle, Wash. Guest of Honor—Terry Brooks, Fan Guest of Honor—T. Bryan Wagner. Registration—$30 until 2 January 1995, $35 at the door. Info: Rustycon 12, Box 84291, Seattle, WA 98124.

17-19 February 1995
BOSKONE XXXII (New England SF conference) at Sheraton Tara, Framingham, Mass. Guest of Honor—Diana Wynne Jones, Official Artist—Ruth Sanderson, Special Guest—Fred Lerner, Featured Filker—Talis Kimberley. Registration—$32 until 15 January 1995. Info: Boskone 32, Post Office Box 809, Framingham MA 01701-0203.

24-28 August 1995
INTERSECTION (52rd World Science Fiction Convention) at Scottish Exhibition & Conference Centre, Glasgow, Scotland. Guest of Honour—Samuel R. Delany & Gerry Anderson, Fan Guest of Honour—Vin¢ Clarke, TMs—Peter Morwood & Diane Duane. Registration—£60/US$95:CDN$120/DM160:DFI 180 until 30 September 1994, Supporting—£15/US$25/CDN$30/DM40/DFI 45 through 1995. At-door-rates not set as of the time of this listing but will be greater than current attending rates. This is the SF universe's annual get-together. Professionals and readers from all over the world will be in attendance. Talks, panels, films, fancy dress competition—the works. Join now and get to nominate and vote for the Hugo Awards and the John W. Campbell Award for Best New Writer. Info: Intersection, AdMail 336, Glasgow G2 1BR, UK or Intersection@smof.demon.co.uk; intersection, Box 15430, Washington DC 20003-4030, USA. (301) 345-5186 voice/fax. ■

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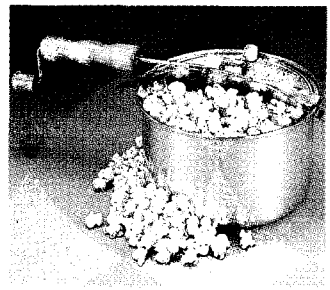

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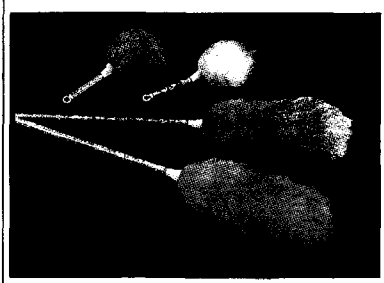

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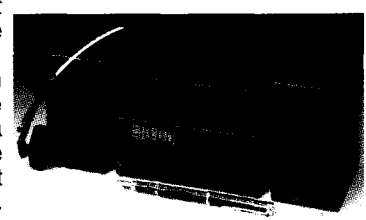

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